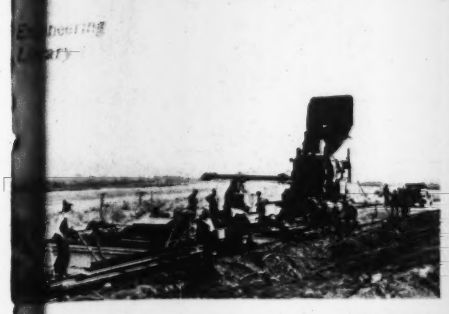

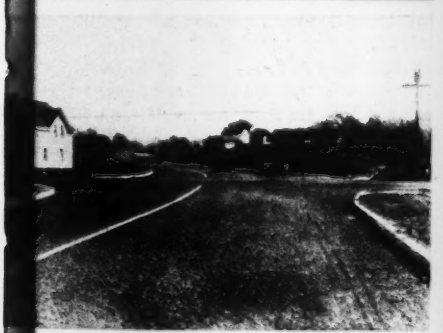

1934

Engineering News-Record

JANUARY 18, 1934

McGraw-Hill Publishing Company, Inc.

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ROAD BUILDING AND THE FUTURE

DURING the great depression emergency of the past four years the road-building art has played a remarkable part. The national government called upon it as a major agency in coping with serious unemployment and business stagnation. It met the call. The federal emergency road-building campaign kept thousands from the bread lines and reclaimed other thousands. While performing this service, highway construction also added $600,000,000 of efficient, dividend-producing investment to transportation service. This is a fraction of the work of other years; but it is a most significant fraction. For in the emergency activities the highway problem experienced a reorientation. New principles and methods were placed in control. The feeder road and the city thoroughfare became an integral part of the countrywide transportation system, and their construction was utilized to put in practice new social policies.

● The profound transformation in transport conditions which has gone on almost unnoticed for some years is now becoming visible in the light of the emergency program. The basic concepts of the future highway policy are crystallizing. The men who plan and build highways have begun to study the problems of the next quarter century. To assist them in fuller study, this issue presents a survey of the emergency highway work and some of the factors that will influence the coming years of road-building, in the following articles:

The Program Outlined — Road Building in Winter

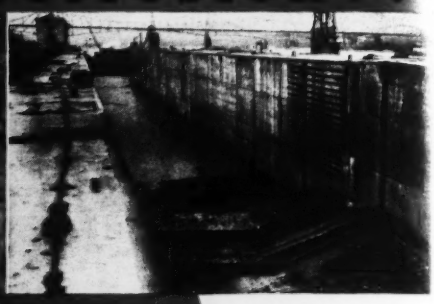
New Contracting Problems — Work on Secondary Roads

Aid to Unemployment — Highways Through Towns

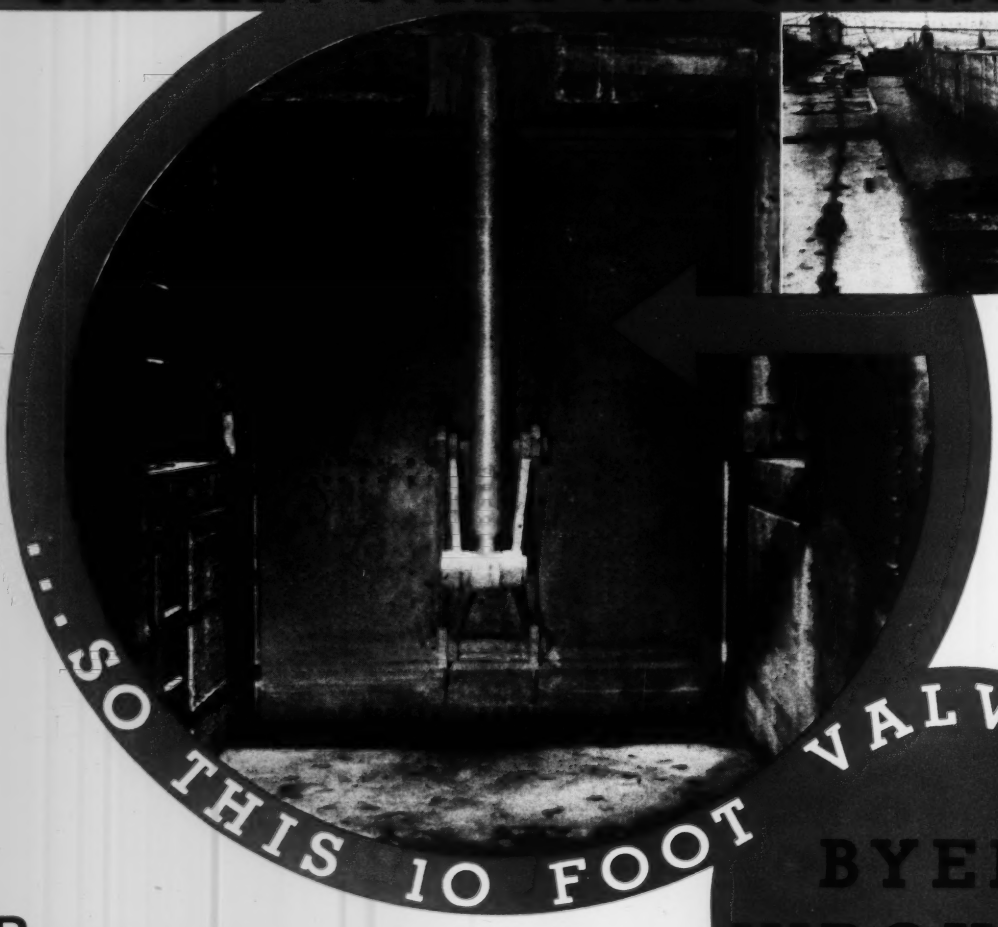
The Future

ANNUAL HIGHWAY NUMBER

Couldn't stand the Corrosion . . .



This 10 foot butterfly valve at Lock No. 2 Allegheny River is made of welded and riveted Byers Wrought Iron Plates, Angles and Bars.



. . . SO THIS 10 FOOT VALVE IS BYERS WROUGHT IRON

BYERS Wrought Iron in flat rolled form has proved to be a new deal for many engineers who have had to reckon with case after case of premature failure. All over the country there has been a definite swing to wrought iron for corrosive services where other metals have proved short lived.

The old butterfly valves in Pittsburgh river waters, subjected to both corrosion and erosion, couldn't "take it." Replacement came too soon. Something better had to be found.

Wrought Iron's long record in river service was reviewed. This was supplemented by its record in even more corrosive service such as salt water, etc. This was ample proof that it would do the job—and, furthermore, because of its longer life, would prove more economical. The result—angles, bars and plates of Byers Wrought Iron are now on the job in this butterfly valve.

Other instances of the increasing use of Byers Wrought Iron are its specification by leading engineers for tanks, smoke stacks, blast and other bridge protection plates—also for dock protection and river and harbor craft hulls, housings, decks and stacks.

Check over the service you are getting. Where metals are failing in 6, 8, 10 or 12 years, the life is too short. See what wrought iron has done under similar services. Let experience and service records guide you.

Through the aid of leading engineers we have collected a wealth of service records covering many fields. This material, together with photos of recent installations, engineering data, estimating prices and A. S. T. M. specifications for wrought iron, are readily available through any Byers Engineer, our Division Offices or our Engineering Service Department at Pittsburgh. A. M. Byers Company, Established 1864. Pittsburgh, Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Los Angeles.

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IN THE NEWS:

THE ST. LAWRENCE WATERWAY treaty is before the Senate with the President's endorsement. The message accompanying the endorsement does not have the convincing ring that has characterized the President's messages heretofore. His implied threat that if this country does not join with Canada in building the waterway Canada will build it within her own borders without our aid will impress only the uninformed.

ENGINEERS distinguishing themselves in an unusual role, one far from the field of the slide rule, are cited by John Kieran, sports writer for the *New York Times*. He says: "The reason for the success of the Army football campaign of 1933 was that, from the very first move, it was directed and conducted by that branch of the service known as the Corps of Engineers." It should be added that Kieran himself wore the engineer's castle during the World War.

SETTING UP RESERVES for bond retirement out of the earnings of the railroads, as proposed by the Interstate Commerce Commission, has implications far beyond the railroad field, if established as a national policy. Savings banks, insurance companies, trusts and endowments have used railroad bonds and the bonds of other public utilities as the backlog of their investments.

THE NEW YEAR has made a start toward equaling the unenviable record of 1933 in the matter of major disasters. Reports from Argentina indicate that there has been a flood on the Mendoza River there, which not only was most serious in its immediate effect upon life and property but also has threatened the livelihood of many not directly affected by sweeping away the diversion dams and intake structures of important irrigation canals carrying water to large vineyards.

A LATE but deserving PWA award will permit the building of a series of bridges on the highway along the picturesque coast of Oregon. At present five state-owned ferries provide the crossings over the river mouths.

BEHIND THE CITIES of Oakland and Berkeley on the east side of San Francisco Bay rises a barrier of steep hills that has seriously interfered with community expansion to the east and has made highway outlets difficult. A PWA award will make possible the construction of a low-level highway tunnel.

IN THIS ISSUE

THE REVOLUTION in roadbuilding is the theme about which this special highway number is developed. The events of recent months are passed in review, analyzed and compared with previous periods. A probable future course for highway development is indicated.

Road construction during the past few years has depended largely on federal stimulant, first a loan of $80,000,000 to the states in 1931, then a loan in 1932 of $120,000,000 (both in addition to regular federal aid of some $234,000,000), and finally a gift of $400,000,000 in 1933. Emergency loans and gifts in three years therefore totaled $600,000,000.

How has the money been spent? What has been accomplished? Briefly, unemployment in the highway industry has been kept at a minimum, the nation's investment in good roads has been increased and strengthened. As a most important corollary, new fundamentals of highway policy have been crystallizing. A revolution, in truth, is taking place.

The reason for this issue at this particular time is not because a new year has begun. Primarily it is motivated by the fact that at this time every year occurs the gathering of roadbuilders, which tends to focus thought upon highway problems, to the exclusion of many others that occupy the profession throughout the year. But this year there is the added reason that highway development has reached a definite turning point.

COMING ARTICLES:

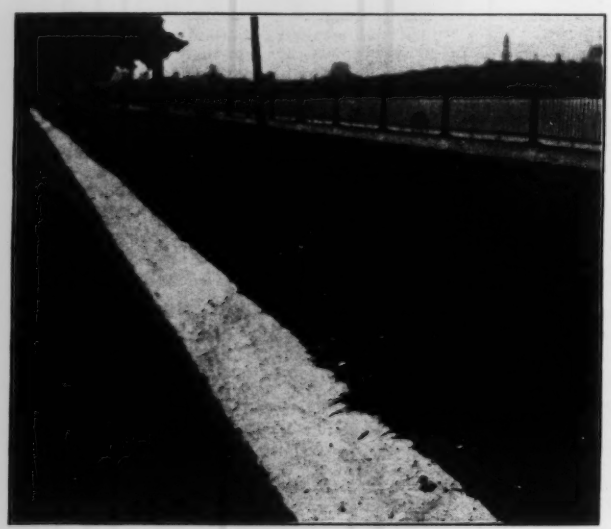
THE ANNUAL MEETING of the American Society of Civil Engineers occurs this week in New York. Next week's issue will carry a report of the technical sessions and of the major accomplishments of the convention.

APPLICATION of fundamental research to cement-macadam road construction has been a notable development of the past year. Under the sponsorship and supervision of the Portland Cement Association the kinds and sizes of aggregates, penetrating and binding qualities of grouts, subgrade treatments, and methods of compacting and curing have been investigated both in the laboratory and the field. The results of these investigations will be published in the Feb. 1 issue.

SOMETHING NEW on retaining walls is at hand. Beginning with olden times, pile formulas and retaining-wall dimensioning have been classic battleground among civil engineers—matched only, perhaps, by permissible loading on foundation soils. Both pile bearing power and retaining walls are finding modern clarification. In the wall field, Dr. Karl Terzaghi, pioneer of soil study in engineering service, has developed by precision testing in a 14-ft. bin, 7 ft. deep, the details of action of various soils on a retaining wall equipped with sensitive weighing devices and capable of predetermined movement forward or back. These are the classic M.I.T. tests, not reported hitherto. They deal with sand, both dry and wet, and with the cohesive mixed soil found in glacial regions as ground till and often called boulder clay. By and large the findings support the practical views of retaining wall design. For one thing, they make all quarrels as between Coulomb and Rankine doctrine appear secondary. Water content and wall movement are far more important than theoretical refinement, it appears. A full report of the dry sand tests, first of a series of five articles covering the entire investigation, will appear shortly—probably in the Feb. 1 issue.

no matter how cold the weather— it is a simple job to install these WHITE CONCRETE CURBS AND MARKERS *That STAY White!*

In winter months, installation of permanent white concrete markers and curbs can go right ahead. Precast sections of both curbs and markers are quickly and easily placed even in zero weather. Made indoors, they are simply moved to the job and set in position. Once installed, these white concrete curbs and markers are permanent, maintenance-free improvements. They never need replacement. Their low first cost is the last cost. White thru and thru, with a smooth, hard, stain-resistant surface, these easy-to-see markers and curbs *stay* white everlastingly. For complete information, write Universal Atlas Cement Co. (*Subsidiary of United States Steel Corporation*), 208 South La Salle St., Chicago.



The Massachusetts State Highway Dept. formerly used natural stone blocks for curbs, with a white cement wash, as shown above. Then it was decided to improve this by using a white cement mortar coat, troweled over the stone.

Now a third step has been taken. Precast white concrete curbs like these are shop-made, then taken to the job and set in place. Advantages: high visibility, simple methods, low first cost, *no* maintenance, installation any time.

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ATLAS WHITE MARKERS AND CURBS

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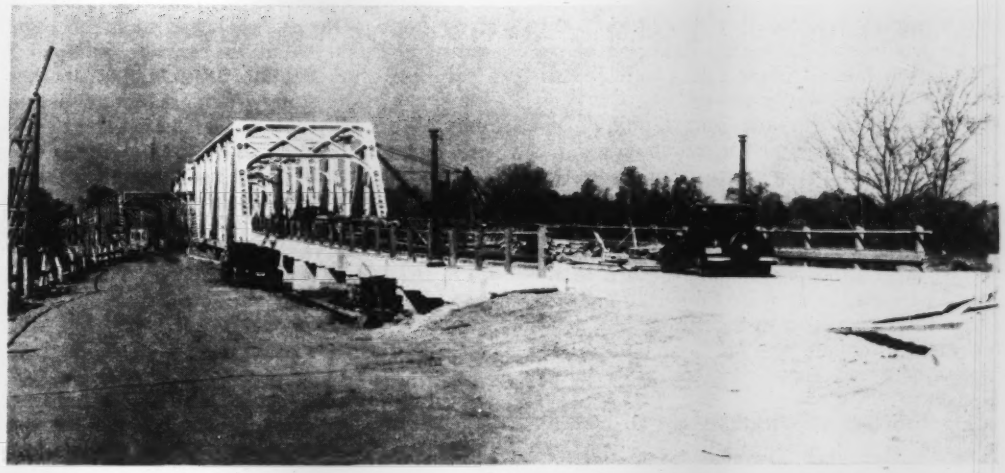
ENGINEERING NEWS-RECORD

ANNUAL HIGHWAY NUMBER

January 18, 1934



NEW BRIDGES for old, straight roads for curved. This view in Maryland typifies highway work with emergency funds.

A New Highway Era

IT IS APPARENT to everyone who gives thought to current developments that three years of intense economic stress and strain are leading on toward a new highway era, indeed that we have already entered the new era. In order that the coming reconstruction may best serve the community, it should be guided by a farseeing, realistic highway plan and program.

The events of the last twelve months are significant in respect to changing highway trends, though the underlying influences have been at work much longer. Roadbuilding was an outstanding leader in the work for recovery and economic stabilization; under severe difficulties and the impact of new problems it made a decisive contribution to employment and helped largely to maintain the vitality of the body economic. These events had the important result of bringing into clearer view the real function and service of the highway program.

Before the trend of highway advance can be duly judged, however, it is necessary first to look at what was accomplished and what new conditions imposed themselves on the emergency road planning and building. To assist in this, *Engineering News-Record* undertook a survey of the problems and changed requirements of 1931 to 1933; the results are brought together in the present issue. The new policies dictated by the unemployment and credit emergency, the changes in planning, contract and labor conditions, the extension of construction through the winter, and the activities in building feeder roads and municipal thoroughfares are individually reviewed. Finally, the theme is projected into the future. Some of the best-informed and keenest students of highway planning cooperated in preparing this discussion.

That a broader plan and a definite continuity of program are essential to the future of highway development needs no proof, once the facts are fully considered. We are building toward progressive improvement of a transportation system—a machine designed to meet a definite, necessary service. The operating demands upon this system are ever growing and expanding, and at the same time they are undergoing change as the youthful business of modern road transportation improves its tools and methods. Therefore the roadbuilder's task changes from moment to moment.

Moreover, this year for the first time in nearly two decades highway policies have undergone a major change, a change that bears vitally on the highway plan of the future. Extension of federal aid as well as the inclusion of feeder roads and city streets in the national network make a beginning toward laying down a larger plan of an integrated system. Though designed only for the emergency, the new policy nevertheless will survive in whole or part if the logic of service requires.

Development of a practical program of highway transportation for the next decade is the controlling task

before the men of the highway arts and industries. It is not something to be accomplished by arbitrary establishment of policies but requires the cooperative thinking of the whole range of interests involved, since it depends on thorough study and farsighted analysis of the conditions surrounding transport and roadbuilding. Of the wide range of facts, requirements and statistics, the major [illegible] are still undetermined. Psychological factors also enter, for the popular attitude of mind toward mobility and transportation as well as toward expenditures and revenues is an important influence that will always require evaluation and careful consideration.

Depleted Finances Threaten Roadbuilding

TREADING on the heels of the fine accomplishment in emergency roadbuilding described in this issue is the problem of the future financing of our highways. This is the fact of immediate practical business concern that faces highway interests.

The present financial danger and uncertainty lie not only in the fact that the income for roadbuilding has sharply fallen off but in the general impression that expenditures have been increasing. If today the general road user were asked to chart off-hand the public-road expenditure, the curve would be an ascending one all through the years with probably a sharp upturn in the last two years. The facts, as they are known to highway officials, are that the curve rose to something like a billion and three-quarters dollars in 1931, and then dipped rapidly to probably about three-quarters of a billion in 1934.

Statistics are notoriously dull reading, but at this time they are vital. Let us look at the figures. In 1932 the total state road income, including federal loans, was $898,317,794, of which 15.3 per cent was federal funds. In 1933, including one-half of the $400,000,000 Recovery Act appropriation, the total income was $721,416,282, of which 32 per cent was federal funds. In 1934, including a liberal estimate of state funds and $200,000,000 of the Recovery Act appropriation, the total will be $644,496,881, of which about 30 per cent will be federal funds—specifically Recovery Act funds, since no regular federal aid was granted by the Congress of 1932-'33.

But the whole story is not contained in these bare figures of income? Of what kind is this income? In part, the money was a regular federal-aid fund applicable only to roads on the federal-aid system. Another part was a $200,000,000 loan to the states, to be deducted over a term of years from future allotments of regular federal aid. In addition to this loan, regular federal aid was continued. A third part was the $400,000,000 Recovery Act appropriation of June 16, 1933. This was a free grant to the states, but with it the regular federal aid of $125,000,000 a year was discontinued.

It is of course quite possible that another Congress may relieve the states of the debt they assumed. Or, it may restore federal aid. Or, it may grant another Recovery Act roadbuilding dole. But at the present moment the federal financing stands as stated. Are the states prepared financially to carry the banner of adequate highway development? At the moment they are not.

In 1932 and 1933 legislatures made large transfers or diversions of state road funds. These indicate, according to reports from all states, that incomes from state funds were $485,725,931 for 1933 and will be $448,704,238 for 1934—decrease from 1932 of $275,725,000 for 1933 and more than $312,750,000 for 1934. Without restoration of the income that has been diverted to other purposes than road improvement, the states cannot continue roadbuilding on the scale of previous years.

There remains only one other roadbuilding agency, the municipalities under the state. In the years before the depression the counties, towns and cities regularly contributed over $300,000,000 to highway expenditures. This sum has been virtually wiped out by doles to unemployed, uncollected taxes and refusal of taxpayers to assume further imposts for roads.

So much for the facts. Shall highway interests accept them in terms of capitulation or of challenge to battle? The answer should not remain a moment in doubt. But the battle can no longer be waged by the processes of the spellbinder. It has to fling into attack every force of conviction that highway development is only well begun; that it has paid in transportation savings; that it has created an investment that must not be jeopardized by neglect. Such a task calls for purposeful research and publicity far surpassing the objectives and finances of present inarticulated association activities.

Is the Profession Prepared?

IS THE HIGHWAY field organized for efficient joint study and action? In submitting this question we do so with full appreciation of the organized groups and activities that now exist. Their objectives are definite and worth-while, and they have contributed much to highway advance and to progressive raising of its standards. The measure of the past, however, is no longer adequate; if the road transportation machine is to remain responsive to the greatly enlarged demands of the coming period, it must restudy its organization and reshape it for fuller service.

That the industry as such should be well organized, to assure that the industrial interest may have adequate voice and may be enabled to contribute to the essential objective of stabilization, goes without saying. As a matter of fact, the industry already has a groundwork of effective organization, which is available for prompt expansion and broader functioning. Parallel to this, however, the technical and administrative profession of the highway field must also have effective organization, for here lies the broad obligation of studying the technique and economics of road construction—the essential basis on which the plan of the future must be founded.

It is here that the highway profession has its great present task. We know that the men who will attend the several meetings of highway engineers and officials during the current month are conscious of the need and the obligation to organize therefor. May their studies and planning be fruitful and lead constructively to effective preparation for the tasks that lie ahead.

Emergency Roadbuilding —How It Was Planned and Directed

Engineers of the Bureau of Public Roads have formed a general staff, backed up by a regimentation of state highway departments, that during the bleak years of depression has waged a real battle against unemployment

ROADBUILDING is passing through a revolution which has altered all previous development procedures and administrational relationships. Beginning in 1930 highway activity changed radically from a rational progress in providing facilities for travel for a growing transportation business to a device for unemployment relief. The new order of affairs succeeded in its main purpose; its relief to unemployment measured into the hundreds of thousands of men kept at paying work. By a very wise provision of legislative authority, which required that direction should remain in the organizations already created and that had functioned successfully for a decade of the most active development of public roads that the world has witnessed, this relief has been given to uuemployment with very little sacrifice of rational progress in road improvement.

A HEAVY FILL AND RELOCATION of the old road at the left eliminate a railroad crossing on the Cheyenne-Laramie road in Wyoming, a route which pays tribute to a great state resource by using an oiled surface.

This accomplishment of a new order in roadbuilding has been as dramatic an event as can be looked back to in the engineering of public roads improvement. Its impact has been felt in vital changes in contractual relations, in prescription of working hours, wages and sources of employment and in dictation of location and classes of improvements. It finds its justification in the general cataclysm of the ordinary procedures of living that is called the business depression. Let us see how it has naturally come about.

Nation and states mobilize to provide road work

With the depression year of 1930, millions of men lost their customary occupations, and no other occupations existed. Leaders in every field of government began to look about to create occupations. An obvious opportunity was highway construction which for a decade had been a large consumer of labor and which was organized through the Bureau of Public Roads and the state highway departments for quick action. Early in 1930 a call from the national administration urged the states to speed up roadbuilding in every possible way to relieve unemployment. The states responded by employing every means to raise money to meet immediately the regular federal-aid appropriation of $125,000,000 and to increase state road work. As the result of this special effort the pace of roadbuilding was accelerated from the $800,000,000 expenditure in 1929 to an expenditure of over $1,000,000,00 in 1930, of which, it is vital to note, $296,000,000 was spent by local governments—county and township. A million men were given work.

With the approach of 1931 unemployment became more acute. In their strenuous efforts of 1930 many states had strained their resources for roadbuilding. Local governments, under the necessity for increased local relief, uncollectible taxes and rebellion against tax increases had virtually ceased road expenditures beyond the driblets of money that came from their allotments of state road tax funds. Yet roadbuilding had proved the most promising means of giving men work, and harassed administrations logically turned again to its succor. In January, 1931, Congress, besides $125,000,000 federal aid, provided for a loan to the states of an additional $80,000,000. This federal money enabled the states to maintain roadbuilding at a speed comparable with that of 1930. Local roadbuilding dwindled virtually to routine maintenance.

It scarcely need be said that 1932 offered no improvement in the regular financing of roads. Local governments still lacked money and state road funds were being increasingly drawn on to provide money for direct relief. Again the federal government came to the aid of the states with a loan of $120,000,000 and $109,000,000 regular federal aid. The $120,000,000 loan was appropriated in July, 1932, and its expenditure was largely carried over into 1933. With the $120,000,000 loan Congress dealt a new hand in federal direction and control. It provided that a maximum of local labor be employed, that a minimum wage should be established by each state and that employment for each worker should be limited to 30 hours a week. Virtually, the national government, so far as the expenditure of its contribution was concerned, assumed rights of broad dictation. These the Bureau of Public Roads translated into regulations and a schedule of requirements for hand labor. By virtue of example and the interlocking of various road funds federal regulations were extended to all state road work.

The present act of the drama of roadbuilding during depression came with the famous National Industrial Recovery Act of June 16 of last year. As it relates to roads this Act and its federal

execution is fully explained later. Briefly, it granted $400,000,000 to the states for road work in 1933 and 1934 and provided $50,000,000 for roads in the national domain. Spread over the 18 months of 1933 and 1934, the Recovery Act appropriation for state road work increases to no very great extent the federal funds made available annually for the years 1931 and 1932. It did, however, greatly extend federal control over state road activities.

A new order arises in roadbuilding practice

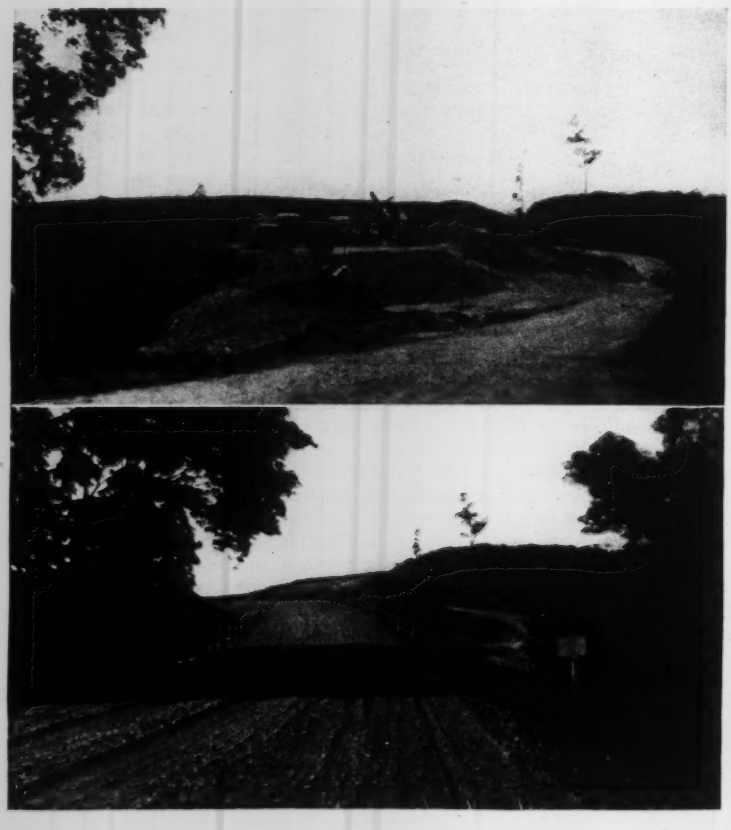
This retelling of roadbuilding activities in the five years (six if we count 1934) of business depression redeems its tediousness by the fact that it is veritably a history of revolution. The order of roadbuilding as it exists at the moment, and furthermore (through Recovery Act code regulation) of the industries that cater to roadbuilding, is no longer as it existed in 1929 and in the years previous, back to the Federal Highway Act of 1921. In every aspect of choice of improvement; contract relations; hours and pay and choice of labor, and methods in which work can be done, the practice and policy of today are new. Not only has the reaction on the agencies for roadbuilding been a vital one, but, more importantly, the new order has placed a stupendous task of planning and administration on the federal Bureau of Public Roads and its autonomous agencies, the state highway departments.

By law the task had to be begun by the Bureau of Public Roads, and being directed specifically to unemployment relief it had to be begun promptly and continued at high speed to completion. How the federal bureau set about its work, planning ahead, foreseeing contingencies, revising its procedure as unexpected contingencies developed and holding a firm hand over technical quality and economic justification is best indicated by the procedure in connection with the Recovery Act grant of $400,000,000. In this planning and administration the bureau drew on all that was best in its practice in administering regular federal-aid and emergency-loan funds.

Federal direction mobilized for quick action

With $400,000,000 to apportion and with each portion to be divided among three classes of highways distributed over at least three-fourths of the counties of each state, the Bureau of Public Roads had a monumental task of selection and planning. Also action had to be quickly taken, for, primarily, the $400,000,000 was appropriated for unemployment relief and for relief in the fall and winter of 1933-4. Preliminary action was taken almost before the Recovery Act was passed on by Congress. This act was unusual as it related to roads; it laid down details to a degree not undertaken in any other part of the public-works section of the Recovery Act. It is important at the beginning to take note of these differences, for they presented new requirements and established new functions for the Bureau of Public Roads and for state highway departments as bureau agencies.

SECONDARY-ROAD improvement in Maine—in top view, the old road under construction and (below) the straightened and wider road after modernization with a gravel surface and guard-rail: a typical local road improvement in the Pine Tree State.



Federal direction stressed by Recovery Act

Except as directed to the common purpose of unemployment relief the parts of the Recovery Act relating to highways differed from those relating to any other public works:

1. Highway construction was the only class of work for which a specific appropriation was made; definite minimum amounts to be allotted to it were stipulated.
2. The appropriation for highway construction was required to be apportioned among all states, the District of Columbia and Hawaii according to a definitely prescribed formula. No such provision was made with respect to any other class of work.
3. Highway construction was the one major class of work that Congress undertook to define in detail. Thus, it was by the law and not by administrative action that definite provision was made for allotment of appropriate parts of the apportioned funds to sections of the federal-aid highway system, to municipal extensions of the system and to secondary or feeder roads.
4. The law entered into considerable detail in specifying certain definite kinds of construction to be favored, naming particularly the elimination of railroad grade crossings, the widening of narrow bridges and roadways, the building of footpaths, the replacement of unsafe bridges, the construction of routes to avoid congested areas, the construction of facilities to improve accessibility and the free flow of traffic and any other construction that would provide safer facilities for pedestrian and vehicular traffic.

It is particularly to be noted that Congress provided that the highway work was to be administered, except for general supervision, by the Federal Emergency Administrator of Public Works, in accordance with the Federal Highway Act—that is, by the Secretary of Agriculture and the Bureau of Public Roads. By the same provision also the state highway departments were retained as the state supervising agencies.

Labor protected by special provisions

One other exceptional condition marked the legislative provision for highway construction—an important one from the standpoint of employment. The determination of minimum wage rates was specifically made a

function of the state highway departments, which departs radically from the provisions made for all other classes of work, on which the fixing of wages was left to the federal administration.

To these exceptional provisions for highway construction, the law added certain conditions relative to the terms of employment which affected all classes of work. These were:

1. No employment of convict labor.
2. So far as practicable and feasible a 30-hour week for labor.
3. Just and reasonable wages, sufficient to provide a standard of living in decency and comfort.
4. Preference in employment to residents of the county or local sub-division in which the work was to be performed, followed by residents of the local state or territory, with first preference in each group to ex-service men with dependents to the extent that a supply of qualified workers of such preferred classes was available.
5. Use of the maximum of human labor in lieu of machinery wherever practicable and consistent with sound economy.

As the directing agency for road work provided for in the Recovery Act, the Bureau of Public Roads had the task of translating all these general and specific provisions of the law into working rules and regulations. Foreseeing its task the Bureau had its work completed almost before the Recovery Act had been signed. Its first purpose was to assure employment.

Opportunity for work widely spread

To spread employment, it was stipulated that one or more projects be provided in at least 75 per cent of all counties in every state, without exception, unless it could be shown that the existing employment need was less widespread or that needed and suitable road projects were not so widely distributed.

To insure a reasonable attention to the serious employment needs known to exist in the cities, and at the same time to encourage the provision of long-needed federal-aid road connections through the municipalities, it was required that at least 25 per cent of the available funds be expended on projects involving the improvement of such municipal extensions of the federal-aid system. Percentage limits were also placed upon the amounts to be expended upon the federal-aid system and upon secondary roads, but these, as will be explained later, were less for the purpose of spreading employment than for the assurance of needed improvements.

Before they were allowed to propose any projects in detail the state highway departments were required to submit for approval a statement of the total amounts proposed for assignment to each of the three general classes of highways and a list of the counties in which projects would be located. This initial statement being approved, the states were then required to draw up and submit a program listing by location and type the projects to be undertaken and the approximate expenditure upon each.

Realizing that this preliminary planning would require some time, the Bureau of Public Roads even before the law was enacted informed the state highway departments regarding the probable terms of the law and the conditions that would have to be met by them after its passage. At that time a number of the state organizations had been severely curtailed in consequence of the budget-trimming efforts of the preceding year. The bureau gave preliminary warning that such organizations should be promptly augmented. It called attention to the availability of large numbers of competent unemployed engineers, gave notice that the higher speed that would be expected under the coming appropriation would have to be attained without let-down of engineering standards, and urged that the departments be adequately manned to meet the coming demands. After the passage of the law the bureau continued with increasing insistence to demand adequacy of state organizations wherever existing weaknesses were observed.

At best the planning required some time—a matter of four or five weeks in most states. At the moment the time required may have appeared as unnecessary delay. In retrospect it is found to have insured the usual benefits of all budgeting and, in this case, the particular advantage of an assured and agreed widespread distribution of the employment afforded by the appropriation. In a number of instances it afforded the means of correcting at the outset plans for the distribution and expenditure of the money that were found to be inconsistent with the employment need. In the long run, it is believed, the brief initial postponement will be more than balanced by the more rapid progress made possible by the preliminary agreement of the state and federal agencies upon the general objectives. In general, the time taken to get set for the race speeded the running which followed, but the spur was not spared during the running.

Trained organizations reduced delay

Looking at the undertaking as a whole (the spending of $400,000,000 on some 6,000 road and street projects), one of the greatest normal causes of delay was avoided by starting with a trained organization. The experienced force of the Bureau of Public Roads was able, with a small addition, to assume the enlarged responsibilities of federal administration. In Washington and in the district offices there was the

ATWOOD AVE. in Cranston, R. I. (in top view), improved to form a part of the belt line around metropolitan Providence by straightening it to pass between the two houses and giving it the high-type pavement which is shown in the lower view.

efficiency gained by years of experience in the administration of the closely similar federal-aid work. The district engineers were already familiar with their districts and in close touch with the cooperating state departments, which were themselves generally long fitted by experience to deal with the task delegated to them. A broad fundamental procedure had already been developed and adjusted to smooth functioning under the requirements of the Federal Highway Act.

However well organized and however forehanded it was with its planning, the Bureau of Public Roads realized that contingencies would arise normally that would call for revisions of plans and regulations, and prepared itself to make the changes promptly.

Practices quickly modified to speed work

For example, it soon became apparent that a number of states, by reason of depleted revenues, would be unable to pay contractors promptly for work done, and that others would be unable to pay for the necessary survey and plans. It also appeared that, because of limitations of local law, some states that had ample funds for work on the state highway systems would be unable to use such funds to survey and plan improvements of secondary roads and municipal streets, and to make progress payments on such improvements. To meet this situation arrangements were made to advance to such states as needed it a part of the federal funds apportioned to them, to be used as a revolving fund.

Again, to avoid loss of time incident to the approval of plans, specifications and estimates for projects, the bureau's district engineers were empowered to authorize the advertising of contracts on projects approved by them without waiting for final approval by the Washington office.

In this same direction when it became apparent that the customary advertising period was responsible for considerable delay in beginning work, the federal rules were amended to require advertising for only two weeks, and the states were urged to conform to the period thus defined instead of the longer customary periods, wherever state laws would permit.

At Washington, further to speed up contracts, the previous requirements of formal signature of project agreements and certification of approval of plans, specifications and estimates by the Secretary of Agriculture were waived and these responsibilities were laid upon the chief of the Bureau of Public Roads.

For the more expensive improvements on the federal-aid system and its municipal extensions, the Bureau of Public Roads insisted upon complete preliminary planning. For the simpler and less expensive improvements of secondary roads it greatly relaxed the requirements. Such improvements, if made by forces under the direct supervision of the state highway department, might be begun, it was ordered, upon approval of the federal district engineer, and without prior preparation of plans; but appropriately simplified plans, sufficient to record the work done, were required to be prepared while the work was in progress.

Where such simple secondary road work was to be done by contract the only additional requirement insisted upon was that an abbreviated preliminary set of plans containing the information essential to bidders should be available before the contract was let, to be supplemented before payment of th final voucher by the same type of plans that was required for direct-labor projects.

Still further to expedite the simpler direct-labor projects the bureau waived approval of the purchase of materials whenever award was made to a low bidder after formal or informal advertisement. For small quantities of materials that might be obtained locally from a number of independent sources, letter quotations from not less than three local dealers were considered sufficient to insure economy of expenditure; but published advertisements were required for the purchase of large quantities that might not be readily supplied from local sources or might be obtained from more distant sources on a basis of competition with materials available near the work.

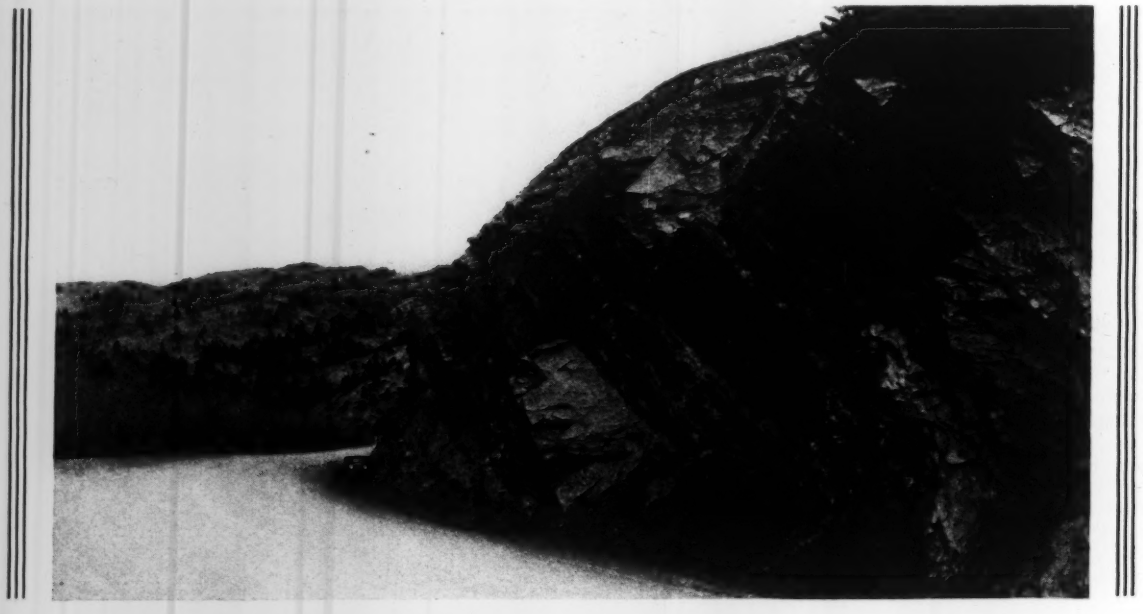
A little wide of the category of modifications of practices, but with the same purpose of hastening employment, stress was laid upon continuous construction throughout the winter. To insure work when wages were most needed the states were required to incorporate clauses in all contracts requiring that work be at once begun and continued through the winter.

Jobs multiplied by hand labor and a short week

The provisions that have been outlined for spreading roadbuilding operations and hastening the procedure of getting road projects under contract had to be clinched, if employment was to be truly wide, by direct prescription of the management of labor.

The law required that a maximum

EXCAVATION on the Helena-Great Falls Highway in Montana called for the heaviest kind of hard rock moving; this view is typical of the conditions in the Wolf Canyon section.



of human labor be used in lieu of machinery wherever practicable and consistent with economy and public advantage. A series of special provisions was therefore prescribed to be incorporated in specifications for the purpose of defining classes of work required to be performed by hand labor. In the drafting of these requirements there was studied effort to avoid increase of employment of labor on the job at the expense of a greater displacement of labor in the equipment industry; with few exceptions the requirements prescribed met with little or no objection.

The general requirement of the law limiting employment to 30 hours a week was modified by special provisions to permit time lost by reason of inclement weather, in any one week, to be made up at any time during the calendar month. If it were found by the state highway department and the federal district engineer that sufficient labor to man the project was not available in the area of the work, permission was given to extend the 30-hour week limitation to 130 hours per calendar month; and where the location was so remote as to necessitate the maintenance of camps an 8-hour day maximum with a limitation of 40 hours weekly was permitted.

These modifications of the law's rigid 30-hour requirement were provided in view of the outdoor and seasonal character of highway work. Where certain classes of skilled labor could not be obtained from employment lists, a further modification was permitted. In such cases the limits established were 8 hours a day and 40 hours a week.

Working hours and hand labor proved a very simple problem compared with that of wage rates. In the Recovery Act, determination of minimum wages for road work was left to the states. This had been the requirement also, as had the 30-hour week, for work with the $120,000,000 emergency loan money, and all of the states had set wage rates to fit their conditions. Since much of this emergency loan construction was still in progress as the Recovery Act grants were being allotted, the wages were current and well accepted practice in the states and in general agreed with by the Bureau of Public Roads.

Into this situation the Public Works Administration injected an independent scale of wages to apply to all construction with Recovery-Act money except roads. In some states this action created discrepancies wide enough to prove distinctly embarrassing to construction operations. As by law the states were independent in respect to wage determination of all Recovery-Act administrations, the Bureau of Public Roads resorted to the determination of a compromise wage scale which, if followed, would avoid the most serious conflicts. This suggested wage scale is given in the accompanying tabulation on page 70.

As will appear, the bureau's schedule recognized the need of three general scales of wages—the lowest for use in southern states, an intermediate scale for a central group of states, and the highest scale for northern states. For each group of states minimum rates were fixed for unskilled and skilled workers and for the intermediate grade of moderately-skilled laborers, who on highway work are more numerous than the highly-skilled workers. Also the bureau's schedule provided different minima for workers who are drawn from the urban and rural communities.

Regardless, however, of rates of wages, definite action was taken to insure that the worker got his pay in real money and that all the expenditures possible within reason should reach labor. The rules and regulations required that wages must be paid in legal tender of the United States (since modified to permit payment by checks negotiable at face value) and no deduction might be made on account of goods purchased or obligations incurred in a commissary or store owned or controlled by the contractor.

Among requirements designed to conserve for direct payment to labor as much as possible of the federal appropriation, were the law's prohibition of federal payment for rights-of-way; the requirement that states that have available revenues should pay the costs of surveys and plans for projects on the federal-aid system and municipal extensions; and the provision requiring state-owned equipment on direct-labor projects to be supplied rent free.

Prompt action taken against discrimination

Besides its direct guardianship of labor the Bureau of Public Roads took definite action to protect it by the indirect encroachment of discrimination and unreasonable profits.

All contracts were required to be based upon open specifications and awards made to the lowest and best bidder. Neither state nor local governmental agencies were permitted to compete with private contractors. The states were not permitted either directly or in the guise of requirements for prequalification of bidders to discriminate against bidders resident in other states.

CONSTRUCTION of this Idaho bridge over a deep canyon and a railway required the handling of falsework, forms and concrete from the high banks by an overhead cableway.

Contracts providing price differentials in favor of, or requiring the use of materials produced within any state were prohibited by the rules and regulations, and the accomplishment of a similar object by direct state purchase of materials was also prevented, by rules and regulations requiring the contractor to furnish all materials entering into the work.

Unless it could be shown that there were available within the state enough unemployed qualified engineers, trained in highway construction, to perform all services required, restriction of engineering employment to residents of the state was discouraged by refusal to pay any part of the costs of surveys, plans and engineering supervision where such discrimination was practiced.

Sound projects demanded despite need for quick action

Dedication of a portion of the $400,000,000 appropriation to construction of secondary or feeder roads marked the first departure of the federal government from the policy of strict limitation of its aid to improvement of the principal interstate roads. To avoid unwise frittering away of the expenditure upon unimportant disconnected local roads, the rules and regulations defined the terms "secondary or feeder roads," as used in the Act, to mean roads which were not before included in the federal-aid highway system, but which were either part of a state highway system or important local highways leading to shipping points or permitting coordination or extension of existing transportation facilities.

First in order of priority among preferred projects listed in the rules and regulations was the closing of gaps in the federal-aid highway system. After this the projects listed were: appropriate landscaping of parkways or roadsides on a reasonably extensive mileage; correlating and supplementing existing transportation facilities by road, rail, air and water, and providing service to freight-receiving stations, airports and emergency landing fields; reconstruction designed to reduce maintenance costs and decrease future state and local highway expenditures; elimination of hazards to highway traffic, as by separating grades at crossings, widening narrow bridges and roadways, building footpaths, replacing unsafe bridges, constructing routes to avoid congested areas, and constructing facilities to improve accessibility and the free flow of traffic.

The right was reserved by the federal agencies to require construction of any roads that might be desired by the Federal Coordinator of Transportation for the purpose of providing adequate year-round highway service in replacement of branch-line railroad service proposed to be abandoned.

Wherever practicable and feasible, as determined by the Bureau of Public Roads, all projects on the federal-aid highway system and its municipal extensions approved after Jan. 1, 1934, were required to provide right of way at least 150 ft. wide. Under the same conditions secondary highways were required to have at least an 80-ft. right of way.

Roadside improvement, including the flattening of cut and fill slopes, the sodding or seeding of banks and shoulders, the obliteration of construction scars, the preservation of desirable existing plant growth and the planting of trees and shrubs, was also required (on all projects approved after Jan. 1) wherever practicable.

A recent requirement also stipulated that at least 0.5 per cent of each state's apportionment must be devoted to such roadside improvement.

Requirements affecting the design of roads included in the federal-aid highway system remained substantially unchanged by the new law and the rules interpreting it.

Municipal projects might include all work necessary for a satisfactory completed improvement, including curbs and gutters, catch-basins, drop inlets, storm-water sewers, adequate returns at intersecting streets, and the adjustment of existing facilities such as sewers, water mains, gas mains, and conduits, except when local laws required such adjustments to be made by the owners.

Paving of the width necessary for accommodation of moving traffic and parked vehicles was also held to be a proper charge against the federal fund.

Designs of secondary or feeder roads were required to be consistent with the character of the traffic to be served. Under this classification the state highway departments could include sections of the state highway system; in such cases standards of location and design comparable to those established for the federal-aid system were required. In other cases, secondary roads might be of local importance only; for these the following minimum standards were established:

1. Adequate width of right-of-way.

2. Natural rolling grades consistent with reasonable safety and easy-riding profile.

3. Adequate cross-road and side-road drainage.

4. A graded width of roadbed in easy topography of not less than 26 ft. out to out of shoulders and in rougher topography 24 ft. out to out of shoulders, with an absolute minimum width of grading of 20 ft. overall in mountainous country.

5. Alignment involving no sharp turns or other features likely to be dangerous for the anticipated volume of traffic.

6. A minimum surfaced width of 10 ft. for single-track roadways; a minimum of 14 ft. for an estimated maximum daily traffic of 250 vehicles; and a minimum of 16 ft. for an estimated maximum daily traffic in excess of 250 vehicles.

WAGE RATES FOR EMERGENCY HIGHWAYS

Suggested rates for projects within or adjacent to cities of 100,000 population or more and in the area of large industrial plants or mining operations. Wage rates in rural areas should be not more than 25 per cent below urban rates.

	Per Hour
Southern zone:	
Skilled labor	$1.00
Labor (intermediate grade)	.65
Unskilled labor	.45
Central zone:	
Skilled labor	$1.10
Labor (intermediate grade)	.70
Unskilled labor	.45
Northern zone:	
Skilled labor	$1.20
Labor (intermediate grade)	.75
Unskilled labor	.50

Southern Zone

Alabama	Mississippi
Arkansas	North Carolina
Delaware (southern)	South Carolina
Florida	Tennessee
Georgia	Texas
Louisiana	Virginia
Maryland (southern)	West Virginia

Central Zone

Arizona	Maryland (northern)
California	Missouri
Colorado	Nevada
Delaware (northern)	New Mexico
District of Columbia	Oklahoma
Kansas	Oklahoma
Kentucky	Utah

Northern Zone

Connecticut	New Jersey
Idaho	New York
Illinois	North Dakota
Indiana	Ohio
Iowa	Oregon
Maine	Pennsylvania
Massachusetts	Rhode Island
Michigan	South Dakota
Minnesota	Vermont
Montana	Washington
Nebraska	Wisconsin
New Hampshire	Wyoming

Conclusion

Four broad facts stand out in this outline of federal direction of the emergency road work of this and the preceding three depression years: By its large financial contributions federal highway authority has assumed virtual dictatorship of public road development. Roadbuilding activities have been predicated upon creating employment rather than upon a normal order of autonomous state management of a highway transportation system. This new order has affected road contracting, road construction practices and state relations to road administration in the subsidiary governmental units of counties, townships and municipalities.

What have the effects been? Has the emergency road program accomplished its main purpose of increasing employment? Have the states carried out wisely their new responsibility of participation in local road development? To gain information that would aid in answering these questions *Engineering News-Record* has conducted a survey (by personal visits) of practice and experience in some twenty of the leading roadbuilding states and drawn largely on the services and records of the Bureau of Public Roads and the Association of State Highway Officials. The results obtained are summarized in the five articles which immediately follow.

Survey of Emergency Roadbuilding Plans and Progress

CONTROL of state roadbuilding from the national capital, which was brought about by the successive federal loans and grants amounting to $600,000,000, as outlined in the preceding article, naturally could not fail to produce repercussions on the existing order. So profound a transformation of power and direction could not take place and leave all things as they were. What were these effects?

Coincidentally, the new order placed unfamiliar and stupendous tasks on old organizations created and built up for far more limited duties. How did these organizations function?

To answer these questions, *Engineering News-Record* undertook a survey of states by personal visits of editors and by wide correspondence. The records and services of the U. S. Bureau of Public Roads and the American Association of State Highway Officials were freely drawn upon. Many projects carried out with emergency roadbuilding funds were visited in the field, and organization, employment and technical performance were observed. The many facts and impressions gained crystallized into five main considerations:

1. Effect on contracting practice and construction methods.
2. Amount and spread of unemployment relief.
3. Extension of employment season by winter work.
4. Developing a feeder system of secondary roads.
5. Developing continuity of main roads through cities.

The five articles that follow consider these subjects. They represent the only published appraisal yet made of one of the most momentous movements in the history of American roadbuilding.

New Contracting Conditions for Emergency Work

Required use of local unemployed labor and shortened working week have made changes necessary in construction procedure, proved a hazard to equipment and made management of work more complicated

CONTRACTING practice and construction procedure were radically altered by the restrictions imposed by the federal emergency appropriations to give employment by roadbuilding. Beginning with the $120,000,000 emergency loan of 1932, federal orders stipulated a 30-hour work week, the establishing of minimum wages, the performance of many operations by hand and a reasonable employment of workmen from local lists of the unemployed. With the allotment of the Recovery Act grant of $400,000,000 these restrictions were continued and emphasized. Thus over half a billion dollars will have been spent in three years under federal rules that place radically different conditions on contracting and construction. In fact, because of the interlocking of federal and state funds and of the necessity of stabilized practice throughout a state, the changed conditions apply to all state roadbuilding, which in 1932 and 1933 has amounted to about 1½ billion dollars.

How has contracting and construction been adjusted to the new conditions? From a survey made in some twenty states *Engineering News-Record* is able to present a reasonably positive answer. Following a brief epitome of the evidence, a number of briefs of actual testimony are given, quoted indirectly as stated to the editor.

Direct control of construction delegated to states

As made clear in the preceding article, federal control of emergency road construction was exercised directly by the state highway departments. These bodies then had a major task, to be accomplished quickly, of readjusting their organizations and practices to serve many new purposes. So promptly did the states attack their problem that organization had been accomplished almost before the guaranty of actual funds was received. Codes of new construction regulations were prepared.

The new codes in general paraphrased the stipulations of the appropriation acts and the instructions issued by the Bureau of Public Roads, and they may be classified as: (1) rules governing wages, labor hours and employment; and (2) rules governing hand-labor operations. A composite example of these rules will serve to indicate their character.

Before the contract was awarded, the contractor was required to give in person assurance that he understood the rules and proposed to comply with them. They required him to obtain all unskilled labor from a designated county employment committee with the privilege that: (1) if the committee failed to supply lists of workers within 48 hours, workers might be obtained elsewhere, giving preference to local men and ex-service men; (2) executives and skilled labor might be selected without regard to listed men but giving preference to local workers when practicable; (3) any laborer found incompetent might be dismissed but was to be replaced by another listed worker; and (4) release was had from all lists upon evidence of unfair or discriminating practices in establishing the lists.

Labor was classified as executive, skilled and unskilled. Executive employees included the contractor, superintendents, foremen, timekeepers, bookkeepers and clerical workers in positions of especial trust and responsibility. Skilled labor included: operators of power shovels, cranes, concrete mixers, rollers, form graders, finishing machines, locomotives, derricks, pumps, pile drivers and tractors, and mechanics such as steel raisers, fitters-up, riveters, rivet heaters, head riggers, painters, carpenters, concrete finishers, head form setters and similar laborers having "such training in a particular occupation that transference to another occupation would involve a material industrial loss." Unskilled labor included motor-truck drivers, teamsters, and all other labor except executive and skilled.

Hours of labor were, as required by law, 30 hours a week. The minimum wage rates varied in different states. The contractor was warned that the minimum wage named did not estab-

APPLYING asphaltic road oil on "oilmix" gravel construction in Nevada: this type of dustless surface is used extensively and provides a smooth-riding surface at moderate cost.

lish the actual wage which on a specific job he might have to pay as determined by local labor conditions and the requirements of contract time schedules and quality of work, and was also warned that he would receive no extra compensation if the actual wages exceeded the minimum wages specified. As a check on classification, source of labor, work hours and wages the contractor had to make out payrolls in triplicate showing names, residence, classification, class of work, rate of wages and hours worked of all labor.

Camp care of labor was limited to a maximum charge (when only minimum wages prevailed) of 75c. a day for meals and lodging. No excess over fair market prices was allowed in company stores; no fees or charges for jobs. Freedom was to be granted to labor to live and trade wherever it pleased; and no transportation charge to and from work could exceed common-carrier charges between the same points.

Rules for hand labor operations cited

Hand labor was required for clearing and grubbing except blasting of stumps; for trimming slopes and ditches; for trenching, laying pipe and backfilling trenches; for mixing culvert headwall concrete. On culverts and bridges up to 50 ft. hand work was required for excavation and backfill except that explosives were permitted and that hand or team hoists might be used on lifts over 6 ft. Power pumps also were permitted. Hand methods were required in unloading and moving reinforcing steel and concrete materials, charging mixers, transporting concrete, building forms, spreading and removing earth used in curing concrete, handling premixed asphalts, painting, digging post holes, subgrading for and concreting curbs and gutters and sweeping and cleaning.

In general these operations were such as commonly are performed by hand when no restrictions prevail. As stated in the preceding article it was the intention to shun requirements which by increasing the labor in the field would reduce labor in the production industries that find their market in roadbuilding.

Contracting procedure changed in vital respects

These hand operations and employment rules were extended in some states and abbreviated in others, but their general scope and purpose were about those recited. Details are not so important to notice as is the fact that the rules laid down under the Recovery Act had an extensive effect on contractors as well as on such factors as construction speed and cost.

The most telling change in contracting procedure brought about by the new rules was caused by the limitations imposed on hours, wages and sources of employment. Other requirements were not specially new; for example, those relating to housing and feeding workmen and to company stores, employment fees and service charges of various sorts had been the common practice of the better contracting organizations. They proved a salutary force, however, in enabling highway officials to wipe out occasional undesired conditions. Low contract price and the willingness of men to take jobs under any exactions had previously led certain types of contractors to capitalize on depression conditions, and such cases had been difficult to handle; the new regulations gave the needed power.

The limitation of working time to 30 hours a week required a drastic change in payroll organization. In prior years road construction had been organized on the basis of a six-day working week, with a 10 and often an 11-hour single-shift day, working the same men. This intensity of operation was required to prevent excessive rental charges on an expensive construction plant and to give the production necessary to meet low prices and the fast time-schedules that roadwork usually necessitates. In reducing the man-week to 30 hours, the contractor had to employ duplicate crews working alternately 30 hours each, or else devise some other schedule that would permit operating in accordance with the new limitations.

In general, contractors found little trouble in organizing to handle the double payrolls, double timekeeping, increased camp services, and increased accounting. The difficulties of double-crew operation came from other reasons. Particularly in the operation of large machines (power shovels, cranes, bulldozers, mixers and compressors), the employment of two operators alternately made responsibility for maintenance and proper operating conditions difficult to enforce.

Testimony of state survey recounts many difficulties

This brief summary of the state survey of contracting and construction under the emergency loan and Recovery Act requirements, like any digest of testimony, lacks vitality. The speaking witness is required to give life, and in the following quotations he takes the stand. In most cases the quotations are indirect from the editor's notes of verbal statements or informal correspondence. They however represent accurately the experience in important roadbuilding states which may not be identified but which represent a wide geographical and industrial range. The first witness is from the peaks and foothills of the Rocky Mountains:

1. The labor provisions under which these appropriations are used have caused a very marked change in conditions in contract construction. The shorter hours have proved to be beneficial to laborers only where the wage per hour is very materially higher than the wage based on an eight-hour day. Last year (1932) the minimum wage rate for a 30-hour week was 50c. per hour. Contractors were permitted to charge not to exceed $1 per day for board. The laborer receiving $15 per week (if weather permitted his putting in the full 30 hours, which was usually not the case) and, paying $7 for board and say $3 for shoes, clothing and other necessities, had about $5 left for the support of his family. This would buy only the barest necessities in the way of food for the average family. This year the highway commission has secured the approval of a 60c. per hour minimum for common labor and has recommended that this be increased to 70c. per hour. With rapidly increasing costs of living, it appears that 70c. per hour is the least upon which a family can exist decent-

ly, with only 30 hours of labor per week permitted by law.

From the contractors' standpoint there appear very serious difficulties, though not where it was expected to find them. There seems to be no great inconvenience in handling double the number of men required by a 30-hour week instead of the old 48- or 56-hour week, as this simply involves some additional camp outfits and supervision. The big trouble seems to be in the lack of interest shown by the employee.

All contractors note a marked lessening of interest in the contractor's welfare, even on the part of old and trusted employees. Skilled operators of power equipment who under the old system of employment by the month took pride in their output and in the care of their equipment seem to have lost interest and drop off the shovel, caterpillar tractor, elevating grader or other machinery at the end of the shift and leave the job apparently without regard to the condition of the equipment and without reporting needed repairs.

The requirement that all labor come from the county in which the work is being done forces contractors to organize entirely new crews each time they move from one job to another in a different county. This results in the hiring and firing of many men and in very serious depreciation and injury to machinery. Contractors report average repair bills several times larger than were necessary where skilled operators were allowed to remain with the machinery throughout the year or for several years.

The local labor rule also works out unfairly in those counties where it is not practicable to do any highway construction work because of the completion of the road system. In such counties the state highway system in most cases was completed by the help of county bond issues, and thus those counties are penalized for their ambition in securing the early completion of their road systems by having no allotment of road funds possible for relief work at this time.

There is no doubt that the 30-hour week actually spreads employment by requiring more men to be used, but the limitation certainly brings with it many disadvantages and increased unit costs. It has also been found necessary to employ timekeepers on the larger contract jobs, to check evasions of the labor requirement. This, of course, increases the cost of supervision from the state's standpoint.

The outstanding fact of this testimony is that the contractor is injured in the most vital element of his business—fixed capital is destroyed by irresponsible operators of equipment. This is not a lone experience, as many witnesses will testify; two of these from Atlantic coast states of the south speak next:

2. Employment of local labor and changing of crews have in most cases worked out satisfactorily with the exception of operators of heavy equipment such as power shovels, cranes, rollers and tractors. Most contractors who operate heavy equipment keep their operators on the payroll practically all of the time whether working or not. With their hours of employment cut in half a second crew of operators has to be hired, and hired from the men who enroll themselves as heavy-equipment operators on the county unemployment lists. When given trial many of these "supposed-to-be operators" have shown not only lack of efficiency but have damaged the machine in trying to operate it and in some instances have caused serious breakdowns.

ASPHALT ROAD-SURFACING plant building an oil-processed road near Santa Fe, New Mexico; these machines pick up aggregate from windrow, mix it with oil and spread the mixed surfacing.

3. The labor restrictions increase the cost of recovery construction work out of proportion to the increase in employment and in wages. Perhaps the main reason is that the labor must be employed from the county in which the project is located and the personnel must be selected from a local employment list that may or may not contain the names of suitable workers. The contractor is more or less bound to try out the persons certified to him and naturally gets into his organization, temporarily at least, much incompetent help. His cost of supervision and his difficulty in keeping equipment operating is increased. The situation would be greatly improved if the restrictions were so modified as to give the contractor more discretion in hiring his labor.

Equipment operators too few in number

Witnesses ranging from the Pacific to the Atlantic coasts and from the far north to the Gulf of Mexico come forward, two of them particularly, with more moderate voices of criticism. In general, however, the trend of opinion is that reduced working hours and restricted labor markets have hampered contractors and construction.

4. From the contractor's standpoint the entire set-up is changed by the necessity of at least two shifts to keep construction progress up to normal under the 30-hour week and by the change in personnel caused by the hiring of labor from local lists. On the emergency loan projects where only unskilled labor was required to be drawn from federal lists, the arrangement was of little if any hindrance to the progress of the work, but on Recovery Act projects, with labor selection requirements applying to all classes, the finding of suitable employees for skilled work on the lists provided is extremely difficult in many localities. In many instances the contractor is forced to eliminate his key men, upon whom he has relied to carry work through, and in addition considerable time may be lost in trying out men for particular work and finding them unsuitable. Theoretically the plan should work without affecting cost and speed, but in practice master pavement finishers, efficient shovel operators or even capable truck drivers are not to be found in every community.

The cost of construction is undoubtedly increased. Double shifts require double timekeeping and doubled supervision. Labor turnover is greatly increased, not only because of increased personnel on the job but because of the difficulty of obtaining from the lists satisfactory men for work requiring greater skill. The attitude of labor is one of dissatisfaction. In spite of the fact that it is undoubtedly true that without the shorter hours fully half of the workers would be without jobs, the men are dissatisfied with the reduced incomes due to the shorter hours.

5. The expenditure of the past and present emergency funds has, of course, altered the working arrangements of contractors to a certain extent, but the experience has been that it has not caused any undue hardships. There has of course been some difficulty due to shifting crews during the week, and there has been some small increase in cost due to the extra timekeeping, payroll work, etc. Contractors have, almost without exception, worked one crew for 30 hours, beginning Monday morning, and then shifted to another crew for the remainder of the week. This results in some measure of inefficiency, but it has not materially decreased the general efficiency of operation, and has certainly increased the number of men employed. It has not been noticed that the supervision has been increased or that the progress of the work has been retarded.

6. Most contractors have been working two 30-hour shifts a week, by having the week's work start on Thursday, and having the same gang continue through Fri-

day and Saturday of that week and Monday, Tuesday and Wednesday of the following week, then lay that gang off completely for one week and take on another gang the following Thursday to work in the same manner. The difficulties have been with the operation of the large equipment, such as steam shovels, mixers, bulldozers and compressors. The difficulty, of course, is that these large machines are valuable, and in placing two men upon them—one one week and one the next—the contractors are not able to place the responsibility for the maintenance of the machine and its proper operation.

Supervision has been increased, and the labor turnover and overhead expense of the contractor have been materially increased. On one job 25 men appeared to work at the beginning of the week and at the end of the week not one of those 25 men was employed; in other words, the laborer is not suitable for the type of work. This may be a peculiarity due to this highly industrial state, but there are just so many laborers experienced in highway labor who are available, and there seems to be a shortage of this particular type of labor. Labor has not benefited at all due to the reason that highway construction is an eight-month industry, and previous to this time the highway laborer worked ten hours a day for this eight months, and would average approximately 45 hours a week throughout the whole season; now he is averaging less than the 30 hours allowed and consequently his spending ability has been reduced.

Increased cost of work affirmed and denied

The testimony whether construction costs have increased under the new order of contract regulation warrants the verdict of nothing proven. Still the verdict remains that skilled labor is the chief trouble. This opinion comes from the Rocky Mountains and from all the way stations to New England.

7. To date, there has been little apparent effect on cost and speed by the regulations and restrictions as to labor hours and wages. On practically all contracts, contractors have worked six days of 10 hours each per week using two shifts of men. In rural communities three days of 10 hours each has proved most satisfactory, as the laborers often have a long distance to come to their work, and can work for the three idle days on their farms and gardens. This class of labor is also physically able and accustomed to work 10 hours a day. Where the labor is recruited from the city idle and the transportation to the job is simplified, two shifts working 5 hours a day each has been found very satisfactory. On a few contracts, contractors have worked 6 hours a day five days per week. This, of course, affects the progress of the work. Supervision has undoubtedly increased and in some cases contractors have been obliged to carry two men at full time in order to secure skilled operators for mixers, cranes, shovels, etc., as there seems to be no surplus of qualified men for these jobs. These restrictions so far have made but little increased cost as reflected in bid prices.

8. Contractors have changed their organizations completely under the emergency regulations. Formerly the entire crew remained with the organization in going from job to job, now the contractor only keeps his men in supervisory positions on a full-time basis. Difficulty is found in obtaining competent skilled labor in the more sparsely settled counties, also difficulty has arisen in making the contractors adhere to the limited time of working each individual laborer. Labor is acting very favorably toward the present method of distributing the work.

Costs have been increased approximately 25 per cent by restricting labor and setting a minimum wage scale, and the speed of execution of work has not been materially affected. Men in supervisory positions on contractors' payrolls have increased approximately 40 per cent. Shifts are made up of 10-hour working days for three days (30 hours), two in each week. The labor turnover has increased greatly by this reorganization.

9. Spread of employment under the 30-hr. rule is accomplished in various ways. Some contractors work two 5-hour shifts six days a week, others work two 6-hour shifts five days a week, and in some cases contractors work 8-hour shifts employing a crew for 3½ days and then allowing them to go to their homes for the balance of the week while another crew works an equal length of time. Where men have their homes some little distance from the work, many contractors follow the practice of employing a crew the latter part of one week and the first part of the following week and then allowing that crew to lay off for an entire week before coming back to work.

Supervision has not appreciably increased, but on account of the higher wages paid and the larger proportion of hand-labor required the costs have increased somewhat. This is reflected in an increase in bid prices of approximately 10 per cent.

No decrease has been noted in speed, and in many cases the work has been speeded up, as contractors who ordinarily have worked only an 8-hour shift are now working 10 or 12 hours.

10. As far as common labor and some types of skilled labor are concerned, it has been found that the restrictions placed on working time by the emergency loan and Recovery Act have not noticeably increased construction costs. In the case of machine operators, however, the minimizing of working hours is a decided handicap to the contractors and to the state through its effect on equipment. There is no doubt that the necessity of constantly shifting operators to meet a 30- or 40-hour weekly limit, with its attendant slackening of individual responsibility has resulted in considerable damage being done to high-priced machinery.

The establishment of a minimum wage scale is a decided advantage on any project. It serves to place all contractors on an equal footing when bidding, and makes price cutting unprofitable.

Mississippi Valley state summarizes exhaustive study

One of the states having a large steady roadbuilding program for more years than most, briefs the conclusions of a careful analysis of its roadbuilding under the restrictions of the second emergency loan act and the later Recovery Act. These conclusions are a fair statement of opinion as it was found by *Engineering News-Record* in a survey extending much beyond the quotations given.

11. The expenditure of present and past emergency road funds (not to be confused with Recovery Act funds) under restrictions as to labor hours and wages, has materially altered the set-up of contractor control and contractual agreements. This change has been fundamental. Prior to the adoption of the emergency regulations both parties of the contract were primarily interested in the control of materials and the workmanship necessary to obtain the quality of work specified in the contract, the contractor being allowed reasonable tolerance in the choice of methods to secure these results. Since the appropriation of emergency funds with the attendant regulations, the contractor is compelled to revamp his organization to conform to the requirements limiting labor to 30 hours per week, and to adopt methods which will insure primarily that "maximum employment is afforded."

The contractor is forced to divide his efforts betwen securing quality of final work and complying with a multiplicity of detail with respect to methods and labor. The state must also divide its attention along the same lines because the requirements governing methods employed, selection of labor and working hours are as important items in the contract agreement as the specifications defining quality of workmanship required for final acceptance.

The regulations governing the selection of labor make the employment of efficient workmen more difficult. Many of the men comprising the relief lists have no knowledge whatever of road construction and have had no experience in this type of work. This is particularly the case when the construction project is located close to the centers of large population where the unemployed lists are made up largely of men formerly employed in manufacturing and specialized industries.

While it is true that the contractor may discharge any laborer who fails to adapt himself to the work or proves incompetent, he is required to make the replacement from the same list; as he has no assurance that the next man selected will be any improvement over the first, his inclination is to allow the first selection to continue work. This situation provides a real problem in the selection of operators for trucks of 3 tons capacity and under, the drivers of which are included in the skilled labor classification. On a recent grading and paving contract 4 miles long a fleet of 1½-ton trucks in excellent condition was brought on the work at the start of the job; on completion of the project the fleet was little more than junk.

One of the chief problems of administration is to keep the hours of labor within the 30-hour per week limitation. It entails the tabulation each day of the hours worked by each man for that day in order that overtime will not be overlooked and that the man may be permitted to complete the regular schedule of working hours allotted him.

For instance, a truck driver whose regular schedule is 5 hours per day for a 6-day period might be called upon to work 8 hours during one day of this period, due to a breakdown of his truck. If this driver is permitted to work the full 6 days of the period without deduction for the overtime of 3 hours incident to the repair of his truck, his total time for the week would amount to 33 hours and constitute a violation of the labor regulation. It is necessary that the foreman or timekeeper keep an accurate check and notify the driver that his schedule will be completed at the end of the 30-hour period. Except on a very small project, the state is required to assign a man solely to this work to see that the limitation is not exceeded. On the average road contract the operations are so varied and extended that it is difficult to prevent the occurrence of errors, even with the best of organization.

The contractor is permitted to employ skilled labor for the operation of power equipment without regard to the lists. However, the 30-hour limitation makes it difficult to secure such labor at the minimum wage, except where the labor is available locally. Before the contractor is permitted to employ such operators for more hours per week as an offset against the minimum wage, he is required to offer an increase of 50 per cent over the minimum wage for the shorter hour working week. This increases the cost materially and is difficult to anticipate at time of bidding. It would seem that more efficiency could be secured, without materially affecting employment, if the contractor could be allowed to employ operators for power equipment without regard to the relief lists and in case a sufficient supply of such labor is not available locally to permit a longer working week for imported labor of this class.

A more flexible method of regulating hours worked would help much from an administrative viewpoint. If each laborer could be permitted to work 5 hours more in any week than the 30 hours prescribed, with a requirement that such overtime be absorbed during the succeeding week, so that the total hours worked during a two-weeks period would not exceed the 60-hour limitation, most errors in timekeeping and overtime resulting from emergency work could be worked out satisfactorily.

The attitude of labor on these projects seems to be favorable. The men as a rule are glad to get the amount of work afforded rather than accept direct relief. In some cases, however, there is the feeling on the part of labor that the contractor will not discharge unless the work is of a very inferior character, and consequently, in such cases the output per man is reduced. These cases are the exception rather than the rule.

It is necessary for the contractor to increase supervision of the project to take care of the various conditions that have been noted. The size of job, character of work and quality of labor have different influences on the increase, but for the average project 50 per cent would not be an excessive estimate. The supervision and inspection exercised by the state has been found to increase approximately in the same ratio as that of the contractor.

In this state, in which the law governing employment of labor on public works limits the maximum number of hours that may be worked in one day to eight, it has been found that an arrangement providing for two shifts of 5 hours each and a weekly period of 6 days lends itself best from the standpoint of organization and regulation of labor. During the summer months, when it is advantageous to rush the work, three shifts of 5 hours each have worked out with fairly good results. This arrangement, of course, places an additional burden on the supervisory forces. In nearly all instances where two 5-hour shifts are used, the supervisory forces continue in charge during the entire day.

The timekeeper makes a check at the beginning of each shift of the men coming on that shift, and near the end of the 5-hour period he makes a trip through the job and registers the men who have worked the entire shift. Any change in time from the regular hours is reported by the foreman in charge at that time. In most instances the timekeeper, after checking with the state's representative with respect to correctness, sends the daily time sheets to the contractor's central office, where the semi-monthly payroll is made up. As soon as possible after the end of the pay period the payroll is completed and the money is forwarded to the job timekeeper, who makes the actual payoff. The resident engineer or his authorized representative is present to approve the checks or the amounts inclosed in the pay envelopes.

The evidence quoted, as far as inquiry and observation enable determination, is a fair cross-section of opinion and experience. It makes the fact very clear that highway contracting and construction methods of the old order of roadbuilding have been disrupted. In general the evidence makes clear that if construction were relieved of the necessity of using local labor and labor handed to it by a relief official, it could meet most of the other imposed restrictions.

The final conclusion is clear that men have been kept at work and additional men have been put to work by the money from emergency loans and the Recovery Act grants and by the restrictions imposed on the manner of its expenditure. As the great objective of all the emergency highway legislation was employment, the evidence is indication of success. But proof calls for more definite facts, and for these *Engineering News-Record* in its survey has gone back to statistical records which are discouragingly scarce. The following article tells the result.

SURVEY OF EMERGENCY ROADBUILDING

New Jobs Created and Old Jobs Saved

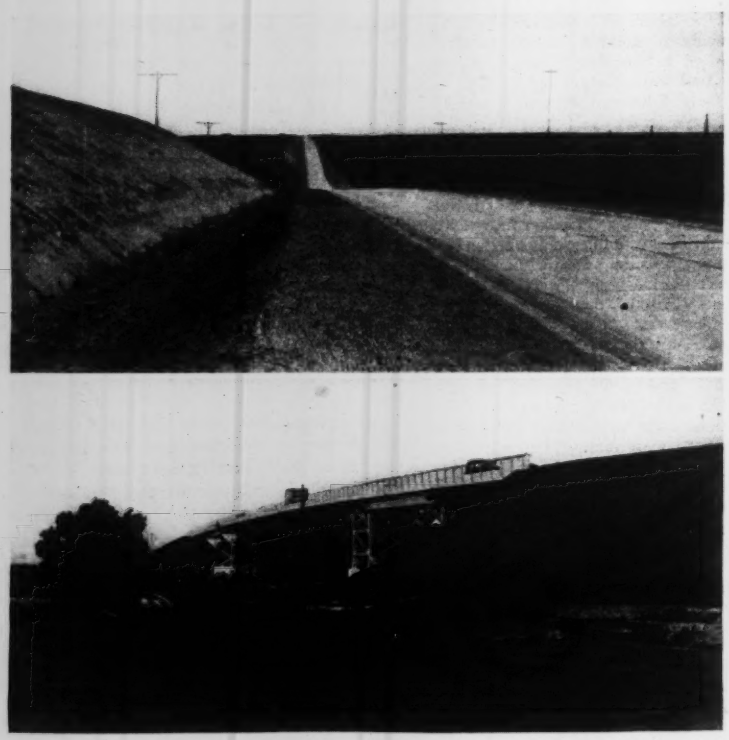
Quick action in getting the federal loans for emergency roadbuilding into actual construction kept some three-quarter million men from the unemployment rolls by continuing their jobs or putting them back to work

AS EMPLOYMENT was the outstanding purpose of the emergency loans and Recovery Act grants for roadbuilding, appraisal of the results is vital. It can be stated at the outset that separate figures of employment provided by the $600,000,000 of emergency money do not exist. An estimate only is possible and this is worked out later in this survey. Obviously, more men were retained in their jobs and were given jobs than if this $600,000,000 had not been spent. The problem is to compute as exactly as may be what the count of jobs is.

In the calculation some review of often-published data (because we have nothing better) is necessary: (1) to provide constants upon which computation can be based; and (2) to furnish proof of the fact, often disputed by forceful critics, that roadbuilding, with modern mechanical plant, is a large employer of labor.

A review of employment in roadbuilding logically begins with the official statistics. These as collected by the Bureau of Public Roads are assembled in the accompanying table for the years covering the main part of the emergency loan work. These counts include no employment on local roads by towns and counties. Nor do they give more than a general indication of the part played by the emergency funds in maintaining or increasing road employment on federal and state roads. But this indication is significant.

Referring to the table, the effects of the two emergency appropriations are noticeable. In July and August, 1931, (the first two months of the fiscal year 1932), the $80,000,000 emergency appropriation of Dec. 20, 1930, was still in course of expenditure. In the corresponding months of the fiscal year 1933, the expenditure of the $120,000,000 emergency appropriation of July 21, 1932, had not begun, and the regular federal-aid appropriations were the only federal funds available. A comparison of the employment on federal projects in these two months of one fiscal year



ROADWAY shown above emphasizes care taken on Nebraska roads in finishing shoulders, ditches and back slopes. Below is an unusual structure combining wood, steel and concrete in a viaduct for an overhead crossing of a railway.

with the same months of the other shows that employment in the fiscal year 1932 period, when the first emergency appropriation was being expended, was almost twice that of the similar 1933 period when only the regular federal-aid appropriation was available.

The figures for total federal and state employment in the last two columns of the table show that the additional employment made possible by the federal emergency appropriation in the two months of the fiscal year 1932 was effective in increasing total employment. In July, 1933, employment on federal projects exceeded the similar employment in July, 1932, by 83,666 men. The corresponding difference in total employment was 79,977. In August, 1931, the federal employment exceeded similar employment in August, 1932, by 62,072, and the corresponding difference in total employment was 56,546. It is apparent that the greater total employment on all federal and state highway work in July and August, 1931, as compared with the same months of 1932, was due very largely to the federal emergency appropriation.

In the remaining months of the two years the situation is reversed, and the greater employment figures are without exception recorded in the fiscal year 1933. In this connection, it will be recalled that the availability of the $80,000,000 emergency appropriation terminated on Sept. 1, 1931, and that the $120,000,000 appropriation became available on July 21, 1932. Federal employment fell off sharply after August, 1931, and increased markedly in September, 1932. For every month after the latter month the effect of the $120,000,000 appropriation is clearly indicated by the excess of employment over the corresponding month of the preceding year when no emergency appropriation was available; and the average increase on federal and federal-aid work was reflected in large part in an increase in total employment.

Increase more apparent in man-months count

During the last ten months of the fiscal year 1932 the total federal employment was 560,610 man-months. In the corresponding period of the fiscal year 1933 there was a total employment of 1,138,283 man-months, a gain, due mainly to the $120,000,000 emergency appropriation, of 577,673 man-months, or more than the entire 1932 total.

In the same two ten-month periods the total federal and state employment was 2,666,058 man-months in 1932, and 3,200,320 man-months in 1933. The 1933 gain, 534,262 man-months, is slightly less than the gain in federal-aid work, indicating that the employment increase provided for by the federal emergency appropriation may have been partly offset by a drop in the employment possible with state funds.

It may be deduced from the table that federal work gave employment throughout the winter of 1932-1933 to more than twice as many men as had been employed on the same kind of work the preceding winter, and also that this additional federal employment had the effect of raising the total winter employment on highway work. From the sharp increase in federal employment in September, 1932, less than two months after the passage of the Emergency Relief and Construction Act, it is apparent that the benefits of the emergency funds were very quickly felt by labor.

Jobs widely distributed among unemployed

In its purpose of increasing employment it is quite as important to know how the work was spread as to know the volume of employment. For these figures we have to go to the states and to the records of such unofficial surveys as have been made. In turning to state records it is incidentally of value to note that inquiry as to increase in employment due to emergency loans brings answers varying from 10 per cent to a four-fold addition. This is not very illuminating, yet so far as it goes it supports the census figures previously given. All told, it establishes that the emergency loans not only forestalled road unemployment but actually increased employment.

Returning to the question of work distribution general inquiry discloses that emergency labor has come from cities, towns and farms in varying ratios in different states. Any count is based on estimates but a count made in January, 1933, covering previous emergency loan construction, permits of the accompanying tabulation. These figures indicate that the spread of relief employment has corresponded fairly closely to the presumable greatest need for work. Neither country nor city has gone unbenefited by the emergency road loans. At present work is not far enough advanced with Recovery Act funds to make any count very certain. It is presumable that the wider spread of expenditures to secondary roads and city streets will extend employment farther than have the previous emergency funds.

The labor breakdown of the road dollar

Contributary evidence of the considerable absorption of labor by emergency loan money is furnished by breaking down the dollar spent in road-building into the fractions that go into the wage envelope. This has been done most carefully for concrete roads by the analysts of the Bureau of Public Roads. Taking 1929 as a year without the stimulant of special appropriations or the

urgency of providing work, an analysis of concrete roadbuilding was made from the records of three typical states. Concrete roadbuilding also was selected because it is the most common of the high types and is mechanized to about the greatest degree of any type, and so is most commonly cited as an example of the displacement of wage earners by machinery.

Balancing the records of actual paving operations, the engineers of the Bureau of Public Roads found the distribution of cost to be as follows:

Item	Per Sq. Yd	Per $1000
Labor	$0.26	$141
Aggregates	0.60	324
Cement	0.60	324
Steel	0.05	27
Equipment	0.185	100
Plant installation	0.05	27
Bonds and insurance	0.04	22
Gross profits	0.065	35

In order to ascertain the amount of labor involved in each of these items an intensive analysis of their component parts was made. This analysis resulted in a distribution of the items under nine headings as follows:

Item	Per $1000
Salaries and wages	$303
Freight	407
Materials and supplies	17
Fuel	35
Interest	14
Taxes	24
Depreciation and repairs	131
Depletion	11
Profit	48
Redistribution	10

Again each of these items was broken down into labor, materials and supplies, depreciation, etc. Adding these labor costs to the $141 direct labor costs, the total amount paid for labor out of the contractor's $1000 is $910. Regrouping and summarizing again on the basis of the road dollar the amounts that go to labor are:

Item	Cents
On the job	15.45
Producing agrgegates	5.0
Producing cement	6.1
Producing steel	0.6
Producing transportation	17.5
Producing equipment	5.27
Producing fuel	3.83
Producing miscellaneous supplies	16.22
Taxes	3.29
Bonds and insurance	3.19
Reinvestment of profits	13.85
	90.30

In brief, only about 9c. of the roadbuilding dollar cannot be traced directly into wage envelopes. Conceding that some of the items near the end of list are largely intelligent guesses, at least eight-tenths of every roadbuilding dollar are wages. The Bureau of Public Roads from its wide experience concludes that "90 per cent and probably more" of the original expenditure ultimately finds its way into wages and salaries.

Employment estimated with Recovery Act funds

As stated previously, it is presumable that Recovery Act grants will go much farther than the emergency loans in spreading employment. At the moment one has only fractional figures and estimates from which to draw conclusions. The schedule of expenditure and employment laid down by the Bureau of Public Roads is shown by the accompanying chart. The data need no explanation.

For such part of the Recovery Act roadbuilding as definite figures, as of Dec. 30, 1933, were available, the records of the Bureau of Public Roads showed 129,346 men at work. This force was divided between contract and day-labor projects as follows: 103,068 men on projects let by contract and 26,288 men on projects on which the labor is employed directly by the highway authorities.

The estimated cost of work under construction on Dec. 30 was $159,575,000, of which $142,360,000 was by contract and $17,215,000 was by day labor employed directly by the highway authorities.

Awards of 4,494 projects at an estimated total cost amounting to $232,490,000 had been made out of a total of 5,287 projects advertised for contract involving an estimated expenditure of

CONSTRUCTION of the old road shown above at the top of Lebanon Mountain overlooking New York from Massachusetts, which as shown below eased the grade, straightened the alignment and opened up the view to the west.

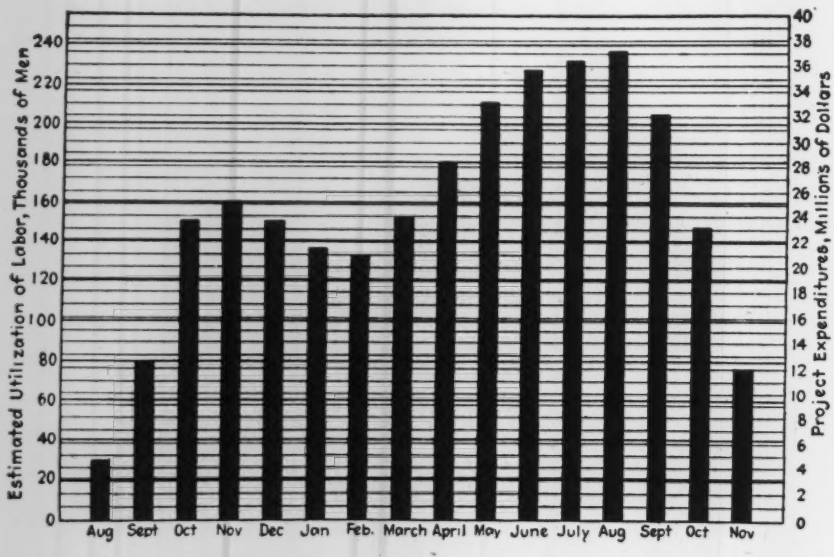
DIRECT LABOR ON FEDERAL AND STATE ROAD WORK
(For years ending June 30, 1932 and 1933)

Month	Federal Roads Year 1932	Federal Roads Year 1933	Federal and State Roads Year 1932	Federal and State Roads Year 1933
July	164,708	81,042	385,349	305,372
August	151,418	89,346	389,949	333,403
September	116,460	122,193	356,617	374,405
October	88,869	124,106	330,104	373,246
November	62,466	129,933	289,316	371,667
December	35,991	98,271	244,971	290,465
January	29,518	74,498	229,189	206,433
February	26,673	78,215	218,218	255,256
March	28,008	95,704	211,549	279,213
April	42,205	122,256	245,843	209,882
May	59,008	139,891	259,615	330,138
June	71,772	152,276	280,686	359,605

DISTRIBUTION OF EMPLOYMENT PROVIDED BY EMERGENCY ROAD-BUILDING PROGRAM

(Count Made Early in 1933.)

State	Per Cent City	Town	Farm
Arizona	—	65	35
Delaware	75	10	15
Indiana	Mostly	—	—
Maine	10	90	—
Michigan	50	50	—
Minnesota	50	30	20
Nebraska	50	50	
New Hampshire	20	80	
North Dakota	—	Practically all	
Ohio		Variable	
Oklahoma	—	50	50
Oregon	50 to 60	40 to 30	10
Pennsylvania		Variable	
Rhode Island	25	75	—
Tennessee	15	70	15
Utah	—	50	50
Vermont	—	50	50
Virginia	50	50	
Washington		90	10



RATE OF EXPENDITURE and amount of employment estimated as practicable by the Bureau of Public Roads with the Recovery Act road appropriation of $400,000,000 spread over sixteen months of 1933-1934.

$233,849,000. The work advertised for contract or started by day labor employed by the highway authorities involved 63.9 per cent of the $400,000,000 provided for highways. There were 476 projects, involving a total expenditure of $11,772,000 reported as completed on Dec. 30. Of these 46 were completed during the week ending Dec. 30.

These figures include direct labor only and if increased by any of the preceding assumptions for spread of employment would give nearly 400,000 men given jobs.

Roadbuilding large employer of construction labor

Buttressing the specific figures given of employment furnished by emergency roadbuilding is the long recognized position of normal roadbuilding as an employer of labor. The figures have been given in a report made late in 1932 to the Association of State Highway Officials by Grover C. Dillman, then State Highway Commissioner of Michigan. The report covers roadbuilding in the United States for the period 1922-1931. Briefly the conclusion was reached that an annual average of 765,000 men were employed. This figure was obtained as follows:

The Bureau of Public Roads statistics show a total of $7,451,573,108 spent for and by state highway departments. For the eight years 1923-1930 the expenditure for local roads was $5,837,380,863, and extrapolating for the two missing years it can be estimated as $7,000,000,000. Of the state expenditures more than $4,500,000,000 went for construction and $1,500,000,000 for maintenance. Of the local road expenditures, extrapolating as before, over $2,000,000,000 went for construction and $2,000,000,000 for maintenance. These figures give totals of about $7,000,000,000 for construction and $3,000,000,000 for maintenance.

It is estimated by the Bureau of Public Roads that for every $350 expended on road construction, taking the average for all kinds of construction and for all parts of the country, direct employment is provided on the construction job for one man for one month. The bureau estimates also that for every man employed directly on the job two others are employed indirectly in the preparation of materials, manufacture of machinery, transportation, etc. Dividing $350 into the total of $4,637,000,000 expended for construction of state and federal roads gives the number of man-months at 13,248,571. This is the equivalent of the steady employment of approximately 110,000 men over the 10-year period, with 220,000 others employed indirectly. Similarly, the amount of money spent on construction of local roads must have given direct employment to 51,000, with 102,000 others indirectly employed. This would make a grand total, continuously employed in road building, of 483,000 men.

State figures confirm those for nation

The proportion of money expended for labor directly on the job and indirectly behind the job varies greatly with conditions. In Michigan, figures assembled on the amount of employment afforded by the expenditure of $1,000,000 in different types of construction work disclosed that $1,000,000 expended in grading and drainage would employ 5,286 men five days a week for 3.[illegible] weeks; in gravel road construction (including grading and drainage), 3,77[illegible] men for 5.7 weeks; and in concrete pavement construction (including grading and drainage), 2,500 men for 5.[illegible] weeks. Reducing these figures to a common basis, the number of men employed for one month in the three cases was, respectively, 4,625; 5,375 and 3,625. The average for all three types of work was 4,540. In other words, the expenditure of $1,000,000 in construction afforded, on the average, 4,540 man-months of work in the State of Michigan.

The money expended for maintenance seems to have been equally effective in providing employment for labor. Michigan statistics show that maintenance funds expended during 1931 totaled $5,567,573 of which 41.4 per cent was paid directly to labor, 36.7 per cent was expended for materials and 21.9 per cent was the cost of depreciation, repair and replacement of equipment. For each dollar of maintenance cost, 0.86 of an hour of direct labor was afforded. Most of the money expended for materials and equipment could be traced to labor, so that it may fairly be assumed that a little over two hours of labor was afforded for each dollar of maintenance.

On this basis, the number of men employed directly in the maintenance of state and federal roads, over the 10-year period, was 50,000, while 69,000 were employed indirectly in producing equipment and materials. On local roads, the number employed directly in maintenance was 70,000, with 93,000 indirectly employed.

With these figures added to the number utilized in construction, the total for both construction and maintenance is brought to 765,000.

Discussion and conclusions

On any of the bases of appraisal that have been presented the emergency loans and the Recovery Act grants have created new and saved old jobs during four years of general unemployment since the money was available. The arithmetic in each case may bring a total having different integers, but the total is always a large number—a number that, as it varied through the months, more often reached nearer to a million men than to half a million. An outstanding feature of this employment has been steadiness during the months when normally there is a sharp reduction. Work in winter has been kept at a high stage of activity. Basically this is the most remarkable change in highway employment that emergency roadbuilding has brought with it. This development and its technical implications are discussed in the following article.

SURVEY OF EMERGENCY ROADBUILDING

Putting Men to Work by Winter Construction

Analyses of large winter programs in northern states show large numbers at work and indicate possibility of extending cold-weather practices into normal highway programs

IN THE RACE to plan roadbuilding to provide work quickly it was realized at once that one of the highest hurdles to be leaped was the season of cold weather, when ordinarily all road work except snow removal was discontinued. Yet winter was the time when the pangs of the empty pay envelope were likely to be most severe. Obviously the spur had to be put to winter construction. This necessity was as fully realized by state highway departments as by the federal highway authorities, and some states in fact took the initiative.

A survey of the operations has developed very positive evidence of the entire possibility of winter road work on an extensive scale and of its fundamental economic justification both as an emergency employment measure and in large part as a regular roadbuilding policy.

Winter work a problem only in limited zones

It was plain at once that winter roadbuilding was in many parts of the country quite as practicable in winter as in any other season. A federal survey showed clearly that, in a very large area of the country, construction the year around is practicable as far as climate is concerned.

This favored territory is not a mere matter of latitude; the all-year roadbuilding zone forms a wide ribbon from Canada down the Pacific coast, swings east to include most of the territory south of the Mason and Dixon line, and bends up the Atlantic coast into New Jersey. In the north along the Canadian boundary of Minnesota and North Dakota and in many scattered mountain altitudes are areas where frost and snowfall make winter roadbuilding impracticable. Between these frigid areas and the all-year zone is the great area here espcially considered, where roadbuilding operations of some or most kinds can be carried on in winter by modern methods at varying increases in cost.

Winter roadbuilding was then a problem of emergency and recovery-fund employment as concerns technical procedure only in those states lying in the median zone. States in the zone where work throughout the year is practicable, except at times in a few operations, have handled their emergency and recovery construction about as usual without regard to season but with some extra effort to schedule projects so that work would be active during the winter months. Procedures in developing winter-work campaigns in the median zone of states are best indicated by data drawn from a few states that have developed excellent procedure.

Ohio set the pace with 1931 bridge work

Of its own initiative the Ohio state highway department began planning in 1931-1932 for winter construction of carefully selected and widely distributed road bridges. The state continued winter work in 1932-1933 and is this winter driving it ahead with increased energy.

Taking the first year, 1931-1932, as an illustration, an appropriation of $3,500,000 was allocated from federal, state and county road funds for bridge building as a winter work-relief measure. The selection of bridge work was determined by several facts: (1) A previous circumstantial survey of bridges on the state road system had shown hundreds to be too narrow or too light to carry modern traffic and so requiring replacement. (2) These bridges were small and so required only materials, equipment and means within the capacity of many contractors. (3) They were widely distributed in every county of the state. These conditions permitted a quick selection of structures in terms of most needed improvement and also a distribution of improvement projects in many localities.

A close estimate was then made of the possible spread of the funds available and the number of projects that could be undertaken. This estimate included an allowance of 15 per cent cost increase for winter work. Incidentally, a close comparison made after the work was done gave 16½ per cent as the probable cost increase. The preliminary estimate showed that the $3,500,000 could be spread to include 350 bridges.

As planned, then, the program called for 350 bridges of concrete and steel and of timber design. Plans were prepared for every bridge. In addition to the standard road-bridge specifications, special specifications were drawn to govern winter work. These covered for concrete work the heating of concrete materials and frost protection of concrete in place, and for timber bridges preservative treatment and millwork necessary to provide timbers completely framed for erection. A force of 30 bridge designers was added to the regular staff to rush the plans and specifications; the first group of contracts was let Nov. 6, 1931, and the last on Jan. 22, 1932. The total contracts included 349 bridges at a total contract price of $3,353,708.

Some of the technique of these winter operations is described later. Here it need only be described as so simple that last winter and this winter the construction of road bridges and roads has become commonplace procedure. In its present winter work on municipal projects, with Recovery Act grants, concrete pavements, using high-early-strength cement, have also become common winter-work operations.

Michigan spends $10,000,000 in one winter program

Similar careful selection and planning were employed in Michigan in its 1931 program of $10,000,000 winter construction, that has since been continued on a smaller scale of expenditure. The Michigan highway officials included a broader range of work in their winter programs. Besides bridges and grade separations the winter projects included grading and roadway widening, drainage structures and ditching, clearing and grubbing. Selection and distribution were carefully considered to include projects of real capital value that could be carried on in cold winter, that were of a size that many contractors and local road officials could handle and that would distribute employment widely. In the case of structures, such as bridges and grade separations, plans were prepared and specifications were drawn governing winter work. In brief, winter work was a thoroughly planned operation. Further account of the technique developed will appear in a following section.

Minnesota winter work with Recovery Act money

As an example to shivering reluctants south of 42, Minnesota, where winters are really frigid affairs, is showing one of the most active of the programs being undertaken with Recovery Act roadbuilding funds. Briefly expressed, the state has a higher percentage of its highway program under way than ever before in the winter months. Clearing and grubbing in the wooded areas, heavy grading, gravel surfacing, stone crushing and bridge building are all enumerated under current winter projects. Contracts all call for immediate construction.

To prepare for this aid to employment, engineers and draftsmen were

SURVEY OF EMERGENCY ROADBUILDING

HANDLING steam-jet-heated aggregate for concrete on one of the bridge jobs of the $3,500,000 winter bridge-building program of Ohio.

worked far into the nights on the program. Instead of lumping its federal funds into a few large projects, the state adopted a policy of spreading the work over the counties as much as possible, while at the same time fitting the jobs into a comprehensive highway plan. While both skilled and unskilled labor are supplied by the national re-employment agencies, county highway engineers also have assisted in advising who should be employed, using their knowledge of local conditions and persons to advantage.

In winter work no elevating graders are used because of the frost, the grading being confined to power-shovel work. In deep cuts the excavation extends enough below the frost line so that production is not seriously reduced. Little frost is encountered in wooded areas, but the more open districts are likely to have frost down 5 or 6 ft. In stripping, which is done with power shovels, precautions are taken to reduce the frost depth as much as possible. Rock excavation is not affected by cold and frost, and this work is readily accomplished in winter.

Gravel-surfacing jobs are organized for almost continuous activity. Crews usually work in two ten-hour shifts, so that trucks and power equipment for screening and loading can be kept warm 24 hours a day. It is essential to keep motors and other power equipment warm because of the difficulty of starting in sub-zero temperatures. Graveling in winter is almost as efficient as in summer, and the cost is about the same because difficulties of cold weather are offset by better hauling conditions over frozen surfaces. Many pits that are inaccessible in summer can be easily reached in winter.

In winter bridge building the sand, gravel and water are heated by steam, and all concrete is housed and heated until it sets. This is an extra cost over summer operations, but it is partly offset by the fact that flood danger is eliminated in winter, deeper excavations are possible without sheetpiling because of less water to contend with, and the danger of caving is reduced. Considerable work is being done on the roadside-beautification program. While no pavement is laid in the winter, grading, bridging and culverts are part of the coldweather program, and this work speeds up paving projects when warmer weather comes.

Careful supervision exercised in winter roadbuilding

These three states whose winter programs have been mentioned specifically are by no means all that have actively undertaken winter work with funds directed to unemployment relief. But their procedure in selecting and distributing work and in planning its prosecution does represent general practice, which has been of high character.

Winter work, whether of primary or secondary character, has been exactingly supervised. On the bridge work of Ohio all construction was inspected by resident inspectors, and in addition two traveling inspectors moved from job to job checking up on all operations. The specifications were also made very precise.

Ohio specifications required that all concrete placed before April 1 and all concrete placed after that date, when the atmospheric temperature was 50 deg. F. or below, should have a temperature of at least 70 deg. F. when deposited in the forms. Suitable inclosures and heating devices were required to keep the temperature of the air surrounding the forms at 50 deg. F. or above for a period of at least 120 hours, when standard portland cement was used and 72 hours when high-early-strength cement was used. The use of salt or chemical admixtures was prohibited.

Specifications of the Michigan state highway department for placing winter concrete required that concrete be deposited in the forms at temperatures between 50 and 75 deg. F., and that no ingredient be heated above 120 deg. F. The time to discontinue heating of protective inclosures was determined in the field by actual results of tests on concrete beams, 6x8x36 in. in size, molded at the time of placing concrete in the unit of the structure which they represented and cured in the housing under the same conditions as the concrete in the structure.

Simple heating of materials provides safe concrete

Emergency roadbuilding has been effective in keeping employment in winter at higher figures than ever before. As a byproduct, it has established a technique that proves winter work possible as a regular practice. An illustration is the timber bridge construction in Ohio in which each bridge member was mill-fabricated and shipped ready for erection. In general, however, construction technique is chiefly of interest in connection with the most controlled processes of concrete placement and protection. These are given from notes on Ohio and Michigan practice.

The most popular method of heating water and the simplest was a steam jet in an open tank of 50- to 100-gal. capacity, which delivered by gravity to the tank on the mixer. This method was quick in its effect, was easily controlled and was fairly economical in steam consumption. Ranking second in favor was the oil-burning or coal-burning salamander containing a water coil. This type of heater performed satisfactorily under most conditions, but when the temperature was low and concrete was being placed rapidly, it had to be forced to provide sufficient hot water. Steam coils in the water tank were little used because large tanks were required for their efficient application.

Steam siphons (ejectors) were employed in a few cases to pump water directly from the stream at the bridge site. The steam siphons both heated the water and pumped it to the tank. On one job in Michigan where this equipment was used the contractor also employed a steam jet to increase and control the temperature of the water in the tank.

Steam jets and grids heat aggregates

Coarse aggregates included gravel, crushed rock and crushed slag. Grills of perforated steam pipes under the stockpiles were the most common and most satisfactory means of heating aggregates. Stockpiles usually were spread to a uniform depth of about 4 ft. over

the pipes, wood plank walls often being constructed to form bins for this purpose. The success of this heating method depended upon using a boiler of sufficient capacity and upon heating the material for a sufficient length of time before starting to mix concrete. Stockpiles always were covered with canvas tarpaulins or building paper to retain the heat.

A 25-hp. boiler operating at 35-lb. steam pressure was found capable of heating aggregates and water for a concrete volume of 80 yd.; the period required for preheating varied from 12 to 24 hours, depending upon the atmospheric temperature. Experience in Michigan showed that a 35-hp. boiler can easily heat aggregates for 80 yd. of concrete in extremely cold weather to 90 deg. F. in a maximum period of 24 hours, and can also supply steam to heat mixing water and housing while concrete is being placed. If a temperature of 90 deg. F. is attained uniformly throughout the pile before mixing starts, it is possible with a boiler of this capacity to maintain the temperature through the day, provided the stockpile covering is removed only as the material is used.

Steam jets were used successfully on a number of Ohio projects to heat the aggregates. The jets consisted of 1- or 1½-in. pipes about 6 ft. long, closed at one end and connected to a steam hose at the other. Each jet pipe was perforated with ⅜- to ¼-in. holes about 1 ft. apart. The outstanding advantage of the steam jet was that it could be applied directly to the portion of the stockpile from which material was being taken. Its efficiency at low temperature is open to question, but at temperatures of 25 deg. F. or above the method worked satisfactorily. Under fairly mild conditions many contractors used steam jets to heat the sand only and relied upon the water to raise the temperature of the coarse aggregates in the mixer. Sand, partly because of its moisture content, takes the heat more readily and retains it better than does a coarse material.

Michigan engineers permitted the use of steam jets if the heating was skillfully done to produce a uniform temperature throughout the aggregates before mixing started. Experience in that state, however, showed that it is almost impossible to obtain uniform heating of aggregates for a large volume of concrete by means of jets, and the method was not encouraged on Michigan bridge projects.

Oil flame injectors mounted on the mixer frame to direct a hot blast inside the drum were employed to a limited extent on Ohio projects to repair loss of temperature in the ingredients of the mix. Several contractors in mild weather dispensed altogether with the heating of aggregates and relied upon hot water and a mixer heater to produce the required temperature in the concrete. Engineers of the Ohio department of highways expressed no objection to the use of the oil-flame injectors, provided combustion was perfect. If imperfect combustion was obtained, they feared that some oil might enter the mix. Oil-flame injectors have been known to raise the temperature of a batch in the mixer drum 10 deg. F. in 1½ min. Mixer heaters were not used on state bridge work in Michigan.

WINTER CONSTRUCTION of asphalt on concrete base on a 7,800-ft. municipal project forming a main-road link and bypass at New Haven, Conn.

Placed concrete kept warm by temporary housing

Inclosures to protect the concrete while it was curing were erected with sufficient clearance around the structure to permit men to work inside the housing. Most contractors used canvas tarpaulins erected on wood staging to inclose the concrete structures. Building paper or roofing paper on timber frames made a satisfactory inclosure on a number of jobs. Wood-sheathed housing proved serviceable on several projects, but its higher cost prevented its wide use.

During the curing process the concrete had to be kept warm and moist. Steam lines inside the housing were the most satisfactory means of providing this double service. The steam pipes were equipped with valves or petcocks or were laid with loose joints to release the steam. In rare cases on Ohio projects, where the inclosures were extremely tight, workmen were unable to strip the forms and rub the concrete in an atmosphere filled with live steam. In these instances some other heating method, such as stoves, had to be used while work was being performed inside the housing.

For several years the Michigan state highway department has required steam lines and boilers to keep placed concrete warm, as this method is considered to offer the only practicable means of maintaining a uniform moisture content inside the housing while stripping forms and rubbing concrete. Several contractors successfully used discarded building radiators equipped with petcocks to heat housing.

Oil-burning or coke burning salamanders, equipped with chimneys to conduct the fumes outside the housing, proved effective in heating the concrete inclosures on many Ohio jobs. The salamanders, however, dried the air inside the housing and made it necessary to cover the concrete with wet burlap after the forms had been stripped. Where no chimneys were used with the salamanders, it was impossible for workmen to remain inside the housing, and fresh air had to be admitted during the stripping and finishing operations.

Concrete was transported from the mixer to the forms in buggies, buckets or tip-over cars on narrow-gage track. By moving the concrete in masses, the loss of heat was kept at a minimum. On jobs where footing concrete had to be placed by means of chutes or spouts, the batch was heated to a higher temperature in the mixer to make allowance for the heat loss occasioned by flow.

Summary

To the trained winter builder there is very little in winter road work that offers insuperable obstacles to continuous winter prosecution. The main problem is to select the work, plan for winter construction and accept the fact that the contractor must bid somewhat higher to compensate him for extra plant and labor to handle it. In Ohio bridge work the extra cost of winter bridge construction figured about 16 per cent.

SURVEY OF EMERGENCY ROADBUILDING

With this discussion of winter construction the survey of emergency roadbuilding turns to a consideration of the activities and problems of one of the most radical moves in the extension of federal aid since it was initiated with an appropriation of $5,000,000 in 1917. The federal government in the Recovery Act took under its initiation and direction over $200,000,000 of secondary roads and city streets. In general, these new duties required a readjustment of the organizations of both the Bureau of Public Roads and the state highway departments. The manner in which the federal bureau undertook its new task has been told. The greater tasks of the states have been made subjects of the present survey, with the results summarized in the two articles that follow.

Selecting Secondary Roads for the Emergency Program

The criteria utilized were their local importance as tributaries of traffic to the federal-aid road system and their ability to furnish local unemployment relief

THE RECOVERY ACT put the national government into secondary roadbuilding for the first time since federal money began to be contributed to states for highway improvement. Neither of the two emergency loan acts implied any necessity of considering other than state system roads. An entirely new administrative and planning problem was therefore imposed by the Recovery Act on the Bureau of Public Roads as general director but more particularly on the state highway departments which had the direct task of planning and execution. Fortunately this duty was less a change for the state highway departments than for the federal bureau and they were able to work faster than might have been expected in taking on a new order of work. But some delay was inevitable.

To recoordinate our thinking with the new situation the facts are repeated. In appropriating $400,000,000 for roads, the National Industrial Recovery Act specifically named secondary roads as beneficiaries to the amount of at least $100,000,000. It was further specified that each state should use one-fourth of its allotment for secondary roads and also that secondary road work must be distributed over at least three-quarters of the counties of the state.

Secondary-road selection generally simple

At the very outset project selection, besides being a new undertaking, presented a question of definition. Nominally the state highway department administers only state roads, the system of primary or main trunk-line roads designated by legislative action as the state road system. For the United States as a whole the state road systems are about 10 per cent of the total road mileage. Introduction by the recovery act of secondary roads into the administrative duties of the state highway departments set up an unfamiliar task. The question of definition lay in whether a secondary road was one wholly outside the state system or included roads of secondary importance in the state system.

Actually previous unfamiliarity with secondary roads proved to be little of an obstacle in selecting and locating the requisite quota of secondary roads. Recent legislation had in some states already placed all roads or very large mileages of all roads in the state systems, and the state systems and the road department engineers had in these states become familiar with secondary feeder roads meriting improvement and also could act with a minimum of negotiation with county and township governments. A count also shows that in most states administrative connection was had in some degree with roads off the state system. Without exact verification the count gives some 8 states which control wholly or in part their county road systems, 36 which aid county roads with or without supervision of expenditures but always with an eye to the work done, 14 which similarly aid township roads, and 21 which aid cities of certain population or on certain streets.

Selection speeded by defining secondary roads

In general then the selection and location of secondary roads for improvement could be based on a fairly complete foreknowledge of the relative condition and importance of these roads as main road feeders. A more important help was created by the definition quite generally adopted by state highway departments, that the meaning of secondary roads in the recovery act included roads having secondary importance in the state road system. This definition virtually extended the classification of secondary roads to any road not on the federal-aid road system, which, averaged over the country, embraces about two-thirds of the state road system. Many states did not go outside the state system in selecting and locating secondary roads for the recovery act program; a few states kept mainly to roads on the state system but did include roads in county and township systems.

While in selecting and locating secondary roads considerable available knowledge and data could be drawn upon, generally no engineering plans had been prepared for the improvement of the road selected. This planning had to be done commonly from the making of surveys through determination of line, grade, roadway, profile and surfacing. State highway department operations were rapidly extended and the personnel increased, but time is required for surveys, plotting, drafting and printing, and the distribution of projects in 75 per cent of the counties made many project plans necessary. At first plans had to be prepared before federal approval of the project, but a later ruling of the Bureau of Public Roads permitted tentative approval and a start of construction before complete plans were submitted. This later ruling did much to speed up construction.

Representative practice disclosed by survey

With the varying conditions and departmental practices in 48 states no standard procedure was possible except in the manner of reporting and planning projects specified by the Bureau of Public Roads, as described in a preceding article. A few selected examples represent quite well the range of policy and practice. These have been selected with no purpose of indicating unusual merit.

California—No difficulty was experienced in finding secondary-road projects to qualify for the 25 per cent of recovery funds allotted for this purpose. There are on the state system nearly 10,000 miles of secondary roads, 6,800 miles of which were added by the 1933 legislature. Though the state had available far more projects than the funds could take care of, many of the feeder-road projects selected are not on the state highway system but are county roads where improvement was urgently needed.

Normally the state is responsible for construction and maintenance of the state system and the counties care for their own roads by their share of state revenues and their own funds. However, prior to the recovery act, the state had cooperated with counties and highway improvement districts to a certain degree, always requiring as one of the tenets of cooperation the approval of plans as well as state inspection or state supervision of construction. In the use of recovery funds the state has held to the tenet of construction supervision, and all plans and specifications have been prepared to state standards by the engineering staff of the Division of Highways. Where counties had prepared plans

and specifications, these were revamped to state standards.

Secondary road projects were selected on the basis of traffic needs and the welfare of the state as well as on the basis of spreading work.

On the opposite ocean coast in Connecticut the secondary roads were all put on sections of proposed trunk lines. The state two years ago appropriated $3,000,000 per year for the construction of secondary roads. This program was in operation prior to this appropriation and has been continued by the state; therefore, the Recovery-Act money was applied to the secondary trunk-line system which was already authorized by acts of legislature to be constructed out of state funds. The selection of types, designs and surfacings was not a problem, as in all cases the minimum type surfacing that had been previously specified by the state for these secondary trunk lines was waterbound macadam.

Turning to the South, a report from South Carolina indicates again that secondary road work was taken on in the regular pace of department planning.

South Carolina—The secondary road program is being handled in very much the same way as is the work on the federal-aid routes. Practically all of the projects included in the secondary road program are included in the state highway system, so that the relation of the state to the work is substantially the same as in the case of the federal-aid program. Some of the secondary roads are constructed to a less width and with somewhat less attention to grades, but all are of types that the highway department has been accustomed to employ. Nine secondary projects have been undertaken with state forces, which is unusual; heretofore all construction has been by contract. It is believed the plan should work out satisfactorily because the maintenance organization is less burdened than usual, work having been cut down as far as practicable because of reduced revenues.

The secondary-road program assumed a different aspect as attention is turned to a state of wide area and sparse population. In Wyoming, for example, selection was based on the local service value of the project. As reported, the points considered in the selection of projects were, first, the traffic the road carries, and second, the industries concerned, such as farming, coal and iron mines, oil well districts and others which have clamored for assistance for some time. In some instances, connections will be constructed between the federal aid and the forest roads.

The work will consist of improving the present earth road, bringing it up to standards of widths, grading and draining required by anticipated traffic. In some cases the road will be surfaced with gravel and in other cases the gravel will be treated with asphaltic oil. The work is being executed by contractors and by force account, in each case under supervision of the department. The plans and specifications will be followed as closely as are other projects under the department. Before the projects are undertaken, the county commissioners agree to finance maintenance.

Turning to the Central West, the domination of the existing road system is again represented in the selection of the secondary roads. For example, the normal relation of the state of Ohio to secondary road work is that it bears the total cost of improvement and maintenance, selects types and design and has full supervision of construction and inspection. The work necessarily must be upon roads included in the state highway system.

The selection of the projects which are being placed under contract was determined by taking into consideration the condition of the present surface and the relief load in the particular localities. The projects being constructed by force account are not on the state highway system and were selected according to their importance as feeder roads to the state highway system and their application to furnishing all-weather roads over which school buses can operate. These roads were all mud or earth sections.

The procedure for the portion of the feeder roads being let by contract is the same as that for letting any contract work on the federal highway system; this also applies to supervision, specifications and inspection. The portion which is being done by force account is under the supervision of the regular maintenance and repair bureau under plans and specifications set up by the state highway department for each particular project.

Secondary projects short and inexpensively surfaced

The secondary roads that have been selected for construction are seldom less than a mile or more than five miles long. There is an occasional variation from normal to 10 or 12 miles. Based on a rough survey of about a thousand secondary road projects an average length of about 3 miles is estimated. With the distribution of work in at least 75 per cent of the 3000 counties in the 48 states this small mileage of the individual project is to be expected. It indicates that the intention of the program to develop primary road feeders and to distribute construction work has been effectively accomplished.

The types of construction are rigid surfaces, high, medium and low type bituminous surfaces; gravel surfaces; and grading only. In mileage these types run in about the following ratios: rigid 2, bituminous 9.5, gravel 9.4, and grading 15.

SURVEY OF EMERGENCY ROADBUILDING

Procedure in planning and construction is made most intelligible by a specific example and for this example the state is selected which has been unusually prompt with its secondary road program. This is the state of Maine.

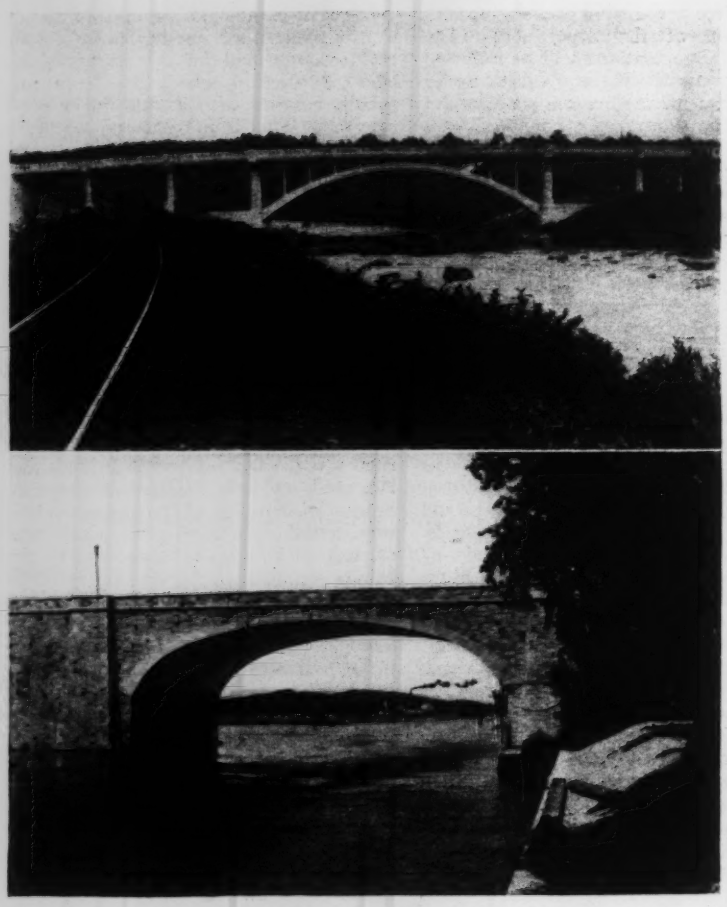
Maine got quickly to work and worked fast. For years the state has been carrying on a program of secondary-road construction by day labor, and has built up an experienced organization and accumulated equipment costing $450,000. With this organization and equipment available, the state was able to step into secondary road work immediately after the release of the federal highway fund, giving early employment to some 6,400 men. Out of Maine's allotment of $3,369,917, one-fourth, or $842,000, was allocated to secondary road work. This fund was divided between 5 bridges and 108 road projects, aggregating about 70 miles. Construction of four more bridges was found necessary after work was started, all nine being taken over by the bridge department of the state, to be built by contract. Small culverts and drainage structures were built by day labor along with the roads.

To make as widespread as possible the relief of unemployment furnished by the secondary road program the projects were kept small and were selected from all the settled parts of the state. Getting work under way at the earliest possible moment was the first consideration. Fifteen survey parties were sent into the field immediately to run out lines and to prepare profiles. Plan drawings were limited to show line and grade, the old road location, property lines, shade trees, pole lines and buildings. These plans were rushed to the district engineer of the U. S. Bureau of Public Roads, and upon his approval, work was started without waiting for formal approval from Washington.

As soon as a project received tentative approval, the survey crews staked out a thousand feet or so of line and took necessary cross sections. The crews went from one project to another as fast as possible, taking time to stake out only enough line to get work started. As construction approached the end of staked out sections, the surveyors doubled back to lay out additional work to keep the project going without delay. These three-man survey crews worked all daylight hours on line and half the night in plotting up cross sections to keep construction under way.

Day-labor plan adopted to give more work

The state highway department believed that by doing its entire secondary road program by day labor it would achieve the greatest success in getting men off the relief rolls. Individual projects averaged less than a mile in length, and cost about $8,000 each, which was considered too small to insure efficient contract construction. On the other hand the state had an experi-



ABOVE: Bridge spans Sugar River in New Hampshire, replacing an antiquated steel structure and eliminating a rail crossing at grade. Below: A bridge at Laconia over the outlet of Winnipesaukee, showing native granite facing that is being used often on the state bridges.

enced key organization and ample equipment. The department had on its payroll 38 experienced construction superintendents. These key men were placed in direct charge of the projects as they developed. Necessary foremen were selected and all labor required was secured from the local communities. Having worked around the state for years, the superintendents were personally acquainted with all prospective foremen, and were able to build up a sound organization on short notice.

Workmen were furnished by relief organizations as needed, the foremen having jurisdiction over the building up of crews. Proper supervision exercised by the superintendents and highway department officials prevented any waste of labor or recruiting of excessive men. The working time was set at ten hours per day, the work to start Thursday morning, enabling a crew to work 30 hours the last half of one week and another 30 hours the first half of the following week. After working 60 hours, a gang laid off for a week, and an alternate crew was employed. Laborers, timekeepers and sub-foremen received 40c. per hour. Foremen were rated at $5 per day, working full time without shifting. Skilled labor, of which little was used, received 45c. per hour minimum. Equipment operators got 60c. per hour and worked 30 hours per week. The state had a full crew of operators for all its equipment. These crews were retained, but worked only 30 hours, their places being taken by relief labor the remainder of the week.

Construction standards kept high

For the most part, all equipment supplied came from plants owned by the state. The highway department owns 79 power shovels of ½ and ⅜ cu.yd. size, and many gravel-screening and loading plants. Most of the grading work was done by these small shovels, though some power graders were used. All trucks were hired locally as needed. Small mixers for culverts were also hired. State bridge crews installed small drainage structures too large to be efficiently handled by the road crews.

The secondary roads were built to the same specifications as standard state-highway gravel roads, except that rolling was eliminated, the surface being compacted by traffic alone. A width of 18 ft. of metal was provided, with shoulders a minimum of 2 ft. in width. After grading, a minimum of 12 in. of hand-knapped stone or selected coarse gravel was laid as a base. The use of stone or gravel for the base depended upon the material available. All rock blasted out of cuts was salvaged for base material. Frequently there was available an ample supply of field stone or old stone fences to provide a suitable base. Where no stone was available, gravel was used for the base; bank run material from pits containing from 50 to 75 per cent coarse stone was used without screening. Gravel and the smaller field stone were distributed to the base in small dump trucks; larger field stone were carried to place on stone boats hauled by horses or tractors.

The surface course consisted of 3 in. of selected gravel. Power gravel loaders equipped with screens dug the material from the pits, rejecting all stones too coarse for the surface layer. Surface material was dumped by truck and spread by hand. Light grading of the surface was continued until traffic had consolidated it sufficiently.

This work has continued along with the federal program; about 2,000 men have been employed on the state-aid work, making a total employment of some 8,400 men on secondary roads.

Summary

As a planning problem the secondary-road program of the Recovery Act was reduced to very simple terms by the definition of these roads as any road not on the federal-aid system. The scattering of the selected projects through 75 per cent of the counties increased the distribution of employment but also slowed down action because of numbers to some extent, but more because of local preferences that had to be adjusted. In general, the states were dilatory in getting secondary-road work quickly under way.

While secondary-road projects fell well within state highway department practice, the projects in municipalities presented a less-known set of conditions and requirements. The appropriation for roads in municipalities gave most states long-wished-for means to close gaps that badly needed reconstruction to through-road standards. These gaps, however, were city streets occupied with surface and subsurface services which had to be readjusted to the new improvements. In the municipal projects the Recovery Act presented federal bureau officials and state highway departments with an unfamiliar problem. Its character and methods of solution are told in the article that follows.

Through-Road Gaps in Cities Closed

Emergency program permitted extending main roads through cities and towns from which regular federal-aid and state road funds had previously been excluded

THE REQUIREMENT of the Recovery Act that a quarter of the $400,000,000 road fund was to be spent for road improvement in municipalities presented a more difficult problem than did that for constructing secondary roads. This is reflected by the fact that municipal projects have been slower to be got under contract and construction. In the past, federal aid generally has stopped at the boundaries of municipalities. No alternative was contemplated in providing the emergency employment loans of $80,000,000 and $120,000,000. The states themselves had restricted their funds generally to roads outside municipalities, but in recent years the practice has been growing in some states of carrying main roads continuously through cities and towns.

This desirable continuity through municipalities of main roads was probably less a consideration in drafting the Recovery Act to include municipal highways than was the belief that reemployment would thereby be more widely spread. Regardless of its purpose, the designation by the act of at least $100,000,000 for municipal roads actually has had the effect of compelling states to consider these roads as integral parts of state roads. This necessitated studies of a different nature than in general had been the duty of state highway departments.

While the problems of the secondary road were on the whole little different from those of the state main road, the problem of the city street contained many factors to which the state road-builder was unaccustomed. The wishes of property owners respecting routing and type of improvement, the requirements of other city services, the rights of public utility companies and various other elements of street service in cities had to be considered.

As independent governing bodies, cities and towns had rights of participation in the selection and planning of the municipal roads. Generally the exercise of these rights involved no opposition, but they had to be deferred to. But a greater obstacle to quick project action came in the actual planning in which often sound engineering required a revamping of underground and street-surface services prior to new street surfacing, which most generally was the extent of the recovery fund undertaking. To get this prior construction put through by the different and in part independent service agencies involved time.

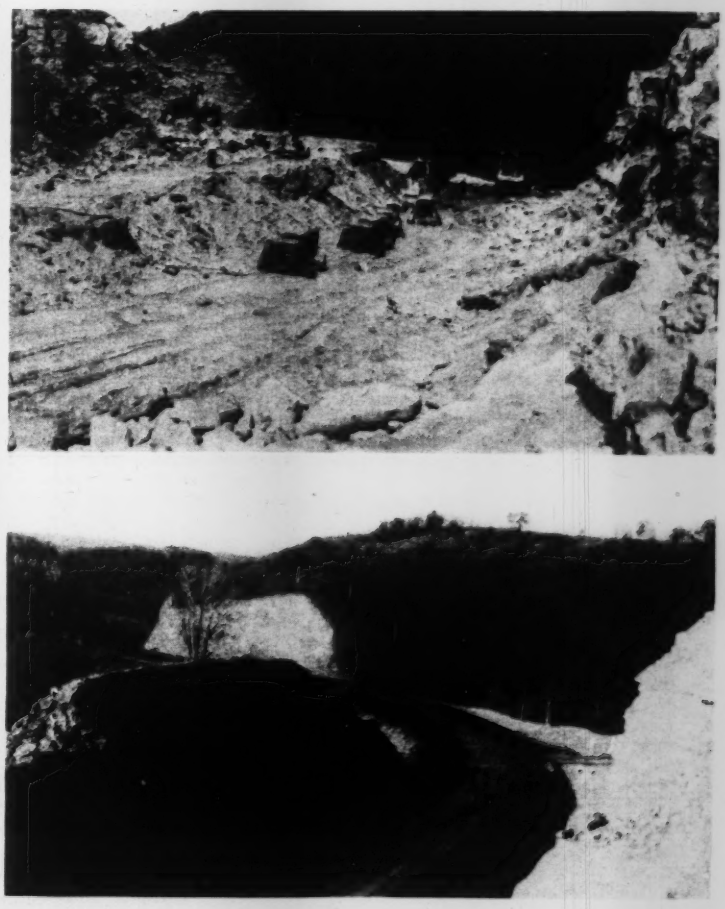
Selection of projects followed no rule

There was no standard practice in selecting projects, as some states were normally participating in road work through municipalities and others were not. The common procedure was for the state highway department to receive suggested projects from municipalities on its system. The number ordinarily was far greater than the funds could construct, but by a process of preliminary selection by department engineers, holding hearings and personal inspection, a practicable list was arrived at. In the smaller group of states that included cities within their road-system planning, and also in states where many municipal gaps existed in the main road system, the highway departments proceeded in larger measure independently in selecting municipal projects.

Representative practice is most definitely presented by giving briefly the notes gathered on opinions and procedure in a number of states.

The experience with the city work has so far been much less satisfactory than with the rural work, because there are so many questions that must be settled before the project can be got under way. In nearly every case there are street-car tracks, telephone, telegraph and power lines to be considered, and quite frequently questions relating to water and sewer systems introduce difficulties. It is the impression that the purpose of the recovery

TOP VIEW shows a rock hill in Minnesota being cut down by air tools to produce the improved road grade shown below; many such rock cuts have been carried through as winter operations by the state road engineers.



SURVEY OF EMERGENCY ROADBUILDING

INTERSECTION in Delaware of a two-lane and the state's famous dual highway, using only an automatic signal to control traffic, as only southbound cars on the two-lane and northbound cars on the dual road actually cross each others' routes.

road program would have been much better served if the city work had been either much less restricted, or altogether omitted. There are many streets in nearly every city that need to be improved and where work could be initiated without much delay, but generally these do not form a part of the federal-aid system. All of the major cities have completely paved the streets that are eligible for the municipal program. They don't want to lose the opportunity for improvement, however, and are insisting that the state reconstruct pavements that would be good for years and that the cities themselves would not normally consider reconstructing if they were paying the bill.

In another state the quarter of the funds set aside for roads in municipalities was allocated to the various municipalities by the state highway commission after conferring with the various officials of the municipalities. All plans were drawn by the municipalities, submitted to the highway commission for approval, bids asked for and contracts let by the highway department and the supervision of the work handled by the highway department. Quoting again:

Several years prior to 1933, the state had inaugurated the policy of allocating a portion of state highway funds to cooperative projects for the improvement of state highway routes through municipalities. The 1933 legislature enacted that ¼c. of the 3c. gasoline tax should be given to municipalities for use in maintenance, construction, and reconstruction on state highway routes and other city streets, under supervision of the division of highways. Many of these projects had been prepared by municipalities and submitted for approval, so no difficulty was experienced in providing acceptable municipal projects.

Recovery projects for improvement of federal-aid routes through cities are all being done by contract under the direct supervision of the state. Even where cities with an adequate engineering set-up have prepared plans and specifications for the work; the state division of highways revises them to state standards and advertises the projects as state work.

Commenting on the benefits of the extension of the federal-aid roads into and through the cities or towns, a Western state points out that it is especially helpful, as the federal-aid highway act allowed no assistance in cities of over 2,500 population except where houses are more than 200 ft. apart, and according to state legislation the state highway commission could not construct state highways in incorporated cities or towns, though they could cooperate in towns of from 700 to 2,500 and (permissible but not compulsory) pay full cost by state funds in towns of less than 700. Continuing, the report states:

The conditions required of municipalities in order for the department to cooperate are as follows: (1) They must secure right-of-way for eliminating objectionable alignment when it can be done without too great expense. As a rule this places no financial burden on the town concerned. (2) They must give the highway department full control over the erection of all traffic signs and route markers on the street concerned. (Towns in adjacent states have been known to place stop signs against through traffic in favor of the local town traffic). (3) They must agree that in future they will not establish curb lines less than 56 ft. apart, or if this is impossible, they must agree to prohibit any parking of vehicles, except parallel and single. (4) They must give the highway department full control over design, construction and maintenance of the highway.

It is stated that practically all of the projects scheduled call for oil asphalt pavement, curbs and gutters. One includes some sewer construction, and another the elimination of a railroad grade crossing provided the city or the railroad will pay any property damages incurred. Another project includes the construction of a bridge in the city limits. A last state reports as follows concerning municipal work:

Emergency funds for roads into and through municipalities have not been a problem because the money could be very readily spent on extensions of the federal-aid system into and through municipalities and through closely built up sections, which prior to this time was prohibited by the federal-aid act. In practically all cases the state was able to extend federal-aid roads into and through the municipalities without any serious difficulty; as a matter of fact, much more money could have been spent this way. Considerably more could have been spent building cut-offs around congested areas, which would be permissible under the act.

Municipal projects in cities, when constructed by state force account, are directly supervised by the various city engineers. Village projects by state force account are supervised by the district highway commissioners through local superintendents or foremen. In connection with municipal projects which are not located on the state highway system, it is required that the municipalities furnish agreements which insure to the satisfaction of the state and the federal government that future maintenance will be properly carried out.

Projects to be built by contract are organized in the same manner as the regular federal-aid contract work.

In order to comply with the federal requirements, the engineering on all municipal projects is taken care of through the department of highways by means of resident engineers. This insures construction which will be entirely in accordance with the plans and specifications, and inspection which is the equal of that on larger highway projects.

The requirement of a minimum roadway width of 36 ft. will result in a better class of construction than has previously existed. The outside lanes, which are primarily for parking, will not receive the same surface type as the center lanes, but will be given a foundation and surface adequate for their purpose. The through lanes on municipal projects will be paved with either concrete or penetration macadam, these requiring the minimum amount of maintenance.

A survey of the secondary and municipal road projects as they have been organized under the Recovery Act administration of roads discloses that isolated disconnected improvement has been the rare exception and such exception has been inadvertent where it is found to exist. In all but these rare instances secondary projects have been direct feeders to the main federal-aid road system. Municipal projects have been in the same generous proportion continuations of, or gap fillers in, the same main-road system.

With several thousands of projects to be selected and planned in a few months, this is a remarkable record of administrative efficiency. It is a tribute to the federal-state roadbuilding organization that has been built up under the Federal Highway Act during the last dozen years.

SURVEY OF EMERGENCY ROADBUILDING

The Future of Highway Construction

Though profound changes have disturbed old governing conditions and principles and brought new controlling influences into action, analysis of present and coming service requirements permits of outlining the development policies of the new roadbuilding era

AS WITH many of the country's major activities, the present time holds out a definite challenge to highway construction. What is its future program? What are the needs and changes that justify it?

The depression emergency imposed highly abnormal conditions on roadbuilding. Local activities were brought to almost complete stoppage, federal construction was greatly increased, as the preceding pages set forth. All told, the extension and even the maintenance of the essential transportation network suffered. Yet the crying need of other calls for the available funds raised doubt in many minds as to the justification for more roadbuilding. And this doubt thrust forward the question: When the employment emergency is over and the highway fund of the Recovery Act is gone, what then? Is further roadbuilding necessary?

These are the questions that many are asking—even some highway men. There is warrant for asking them, and they must be answered, or we fail as highway engineers. This much is sure: the answer cannot be phrased in the old terms. Principles that seemed fixed and immutable a year or two ago have dissolved or changed form. Great movements that had long been gathering momentum have come into collision, and the new courses of advance now require to be scanned.

This instant of time at which we stand is the moment after the collision. It is as if countless billiard balls had all been rolling swiftly toward a common center, each coming on, straight as an arrow, following its own course, until suddenly they all strike together. Where will they each go? What course will they each take when they are through knocking against each other? The chance that any one will continue exactly its former course is small indeed. The highway is the red ball; what way is it going?

If we are to attempt to answer the question at all, we shall probably have to cast an eye back along the previous paths of the balls, and by estimating their forces of impact and angles of movement make a guess as to their future directions.

Backsighting along past course

Suppose we start by looking back along the past course of highway history. No need to look farther back than the coming of the motor vehicle. What has happened since then?

Essentially the automobile influenced the highway by extending its range of service. When for the plodding pace of the draft horse it substituted speed, and for the animal's limited endurance tirelessness, it greatly increased the normal distance of travel by road. The horse had seldom drawn his burden beyond the limits of the county, but the gasoline motor pushed its vehicle quickly past the borders of the state, on into neighboring states, and through these again until it reached and passed the national borders. And whereas the horse-traveled roads were all very much alike in the local character and small volume of their traffic the far-ranging motor vehicle quickly set apart from the general network of local roads a small class of trunk routes, which, fed by the others and joining the principal cities, concentrated upon themselves the stream of accumulated traffic drawn from wide areas and densely populated cities.

New policies of highway administration were shaped to fit the changing need. The restored importance of the highway brought it within the scope of state and national interest. The need for coordinated development of the main routes over long distances precluded effective administration by numerous local authorities, and led directly to state control and ultimately to a share of federal responsibility. The accumulation and rapid growth of traffic on the relatively small mileage of roads which, by reason of location and the inevitable selection of the traffic itself, became trunk lines, have conduced with compelling logic to the creation of the state and federal-aid highway systems and to the priority and higher degree of improvement accorded these limited systems.

Throughout the period of about fifteen years during which efforts of the state and federal governments were concentrated upon the upbuilding of the main trunk lines, there has never been a time when the demands of the traffic using them have been fully met. Within the limitations of available funds, highway authorities attempted to meet the most pressing requirements, however, and though they never succeeded in reaching the goal of an adequately improved main-road system in all parts of the country they steadily approached it.

In increasing degree the funds that made this possible were paid by users in license fees and gasoline taxes. Such payments grew to the point where they covered 90 per cent of the annual expense of the state and federal-aid highways and nearly 25 per cent of the expenditure on local roads. And it was

CONCRETE PAVING in progress in a through cut 180 ft. deep in West Virginia, showing that heavy grading is not confined to the great mountain roads of the far West; this is one of the famous McDowell County highways.

this increase in the contribution of road users themselves that made possible a steady enlargement of the federal-aid and state systems with further relief of the burdens of road cost carried by the local governments.

Work done and work undone

But great as was the increase in the motor-vehicle funds and important as they became as sources of highway revenue, the total revenue available for road purposes never at any time enabled the roadbuilder to catch up with the economic needs of the constantly pressing traffic. Always it was necessary to limit expenditure to the meeting of the most urgent of immediate needs. Never was it possible, as a general plan, to provide adequately against future requirements.

So we find that, with all the splendid work that has been done, and with full recognition of the enormous general improvement in the highways of the country, there are still, according to the latest available figures, more than 92,000 of the 358,000 miles of state highways unsurfaced. Of the surfaced portions more than 156,000 miles are improved with surfaces of low type, many of them even now inadequate for the present traffic; and only about 110,000 miles are improved with the higher types of surface that eventually must be constructed on a large part of the system.

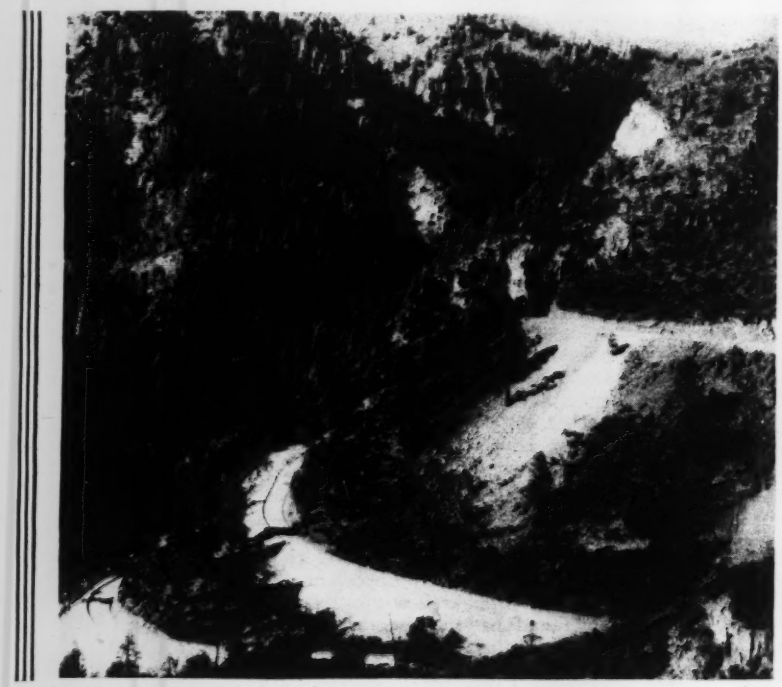
Of the 206,000-mile federal-aid system—the most important roads of our entire network—nearly 30,000 miles remain unsurfaced and 83,000 miles have low-type surfaces. Only about 93,000 miles have been improved with surfaces of high type.

The local roads, of which there are nearly 2,700,000 miles, are in very large part unsurfaced. Only about 600,000 miles have been provided with surfaces of any kind, and on at least 550,000 miles the surfaces are of low type.

It is apparent from these figures that, despite the large amount of work that has been done, there is still much more that must be done before even the most important roads shall have been adequately improved, as to surface only, to say nothing of all the refinements of curvature and grade and intersection design that press for attention. Until these things have been done we shall not have met even the most insistent of present traffic demands.

But quite beyond that, there is a vast amount of effort that unquestionably must be expended if the rural transportation service required by the future is to be obtained. Before we look ahead to that, however, there are some other things of the past that deserve our attention.

As we look back along the course of the red ball—highway history—we see that although it was generally straight and direct there were some undeniable wabblings, especially in the more recent years.



LOOPS ON THE ROAD into Oak Creek Canyon in Arizona. This road winds directly over itself six times in making the scenic climb; a continuous guard-rail borders the edge of the downhill bank.

As the condition of the main highways has vastly improved, the unimproved state of the local roads has been thrown into stronger contrast, and there has been growing discontent among the many whose homes and farms are situated apart from the main lines of travel, over what seems to them to be unreasonable neglect of their local roads.

At the same time it has become increasingly apparent that the systematic and rational improvement of these local roads with reasonable economy and efficiency will not be possible so long as they remain under the sole administration of local authorities. The gradual absorption of the more important local roads into the state highway systems has relieved the most aching needs; but as this process is continued there comes a time when it becomes difficult to distinguish among the vast unchosen mileage the particular miles that should next be transferred to the state administration.

There has been increasing difficulty in the collection of the property taxes that have been the main support of the local roads. Steadily there has been transferred to these roads an increasing portion of the motor-vehicle tax receipts, but more rapidly still the yield of the property taxes has declined. In truth, the property tax has broken down as a means of providing road investment. Whether the condition is temporary or permanent is a question still unanswered, but for some years at least it is certain to hold.

Motor-vehicle taxes—everywhere steadily increased in rate—have produced (until the most recent years) annually increasing revenue. In some states there is evidence that rates have approached close to the point of diminishing returns. In others a considerable further increase would probably be practicable. It has been demonstrated that these taxes are capable of producing sufficient revenue for the support of all thus far added to the federal-aid and state systems, and of leaving a considerable balance for allotment to roads still under local control. How much more they can yield is an open question. That they can be made fully to take the place of the failing property tax is extremely doubtful.

As a matter of old-fashioned economics, the test of which is a favorable balance of return from the investment, there are probably two of our three million miles of rural roads that motor-vehicle owners, as motor-vehicle owners, simply cannot afford to improve. Also, on the basis of the old economic principles, the property tax is more reasonable than any other to supply whatever funds are desired for the improvement of these lesser roads, because the benefits which they confer are mainly benefits to property.

In the most recent years we have seen the effort made to master the difficulties of the local-road problem by

transferring it from local to state authorities. It has been a brave effort, the success of which has thus far been menaced by a tendency to dodge the financial necessities.

And, finally, in this review of the course of our red ball, we see a decided wavering caused by recent doubts and disputes as to the public responsibility to provide for the operation of the larger motor trucks, and the responsibility to the public of those that operate such trucks, especially in the conduct of commercial transportation service.

We have followed our red ball to the present. It is still subject to the influence of many forces. Before we can tell much of its future course we shall have to examine the past courses of some of the other balls and try to estimate their effects.

The railway

To take first the railroads: how do they affect our problem?

In all railroad experience one fact stands out sharply: That the railways have always rendered and by law of their nature must continue to render an incomplete transportation service so far as rail alone is concerned. They must depend upon the highways to accumulate freight for them at one end of their haul and distribute it for them at the other.

The railroads, as they now exist, were built thus to work in double harness with the highways; but the highways with which they were built to work were roads over which loads were moved very short distances by animal power. In other words, *the railroads were built to reach within horse-drawn wagon haul* of the origins and destinations of their freight. Today, now that the economic range of movement over the highways is materially extended by the motor vehicle, it is clear that the railway now reaches farther toward those origins and destinations than economic results can warrant.

This is the cause of most of such duplicate and competitive service by rail and highway as now exists. Clearly the remedy must involve some withdrawal of the railroads within a smaller mileage. What part and how much of the existing rail system must be abandoned to achieve the new equilibrium is a question yet to be answered. The answer will be influenced considerably by what comes out of the present controversy over the size of motor trucks. The greater the load and bulk allowed to be moved over the highway the longer will be the economic highway haul, and the greater will be the necessary withdrawal of the railroad from competition.

The chief concern of the roadbuilder is this: that wherever the railroads let go, there the highways must be prepared to pick up. Therein, the future course of the red ball will be strongly affected by impingement with the white.

Power distribution

Now let us turn to note that there is another important ball: electric power. This ball has been driving straight and hard toward eventual widespread distribution of cheap and abundant power throughout the land—not in large cities only, not confined to cities of any size, but everywhere, town and country alike, throughout the land.

There are tremendous potentialities in this ball, for experience teaches that wherever power is cheap and abundant there industry will develop. In the past such supplies of power have not been everywhere available. Where they were available, there cities have come into being and have grown in size and prosperity.

One of the two principal factors influencing the location and growth of most cities has been the availability of power. The other has been the favor of railroad location. Intersections of rail lines have been spots that above all others have been favorable in the development of cities.

In the past, both of these factors have tended to concentrate industrial growth at certain points—at points where transportation facilities were favorable and power was cheap and abundant. And in both respects the influence of railroad location was predominant: for, the relatively local influence of water power aside, the great source of our power was railroad-transported coal.

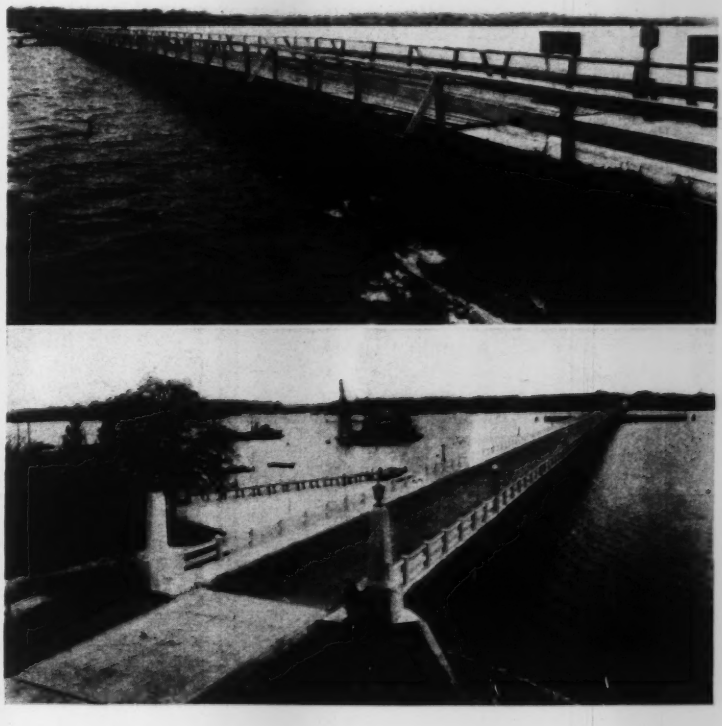
Against these forces that tended to concentrate industry the new widespread distribution of electric power comes to oppose a diffusive tendency, a tendency that is abetted by the presence of motor vehicles ready to serve the transportation needs of the kind of distributed industry it will promote.

The indications are that the blue ball of distributed electric power is likely also to have a great effect upon the future course of the highway red ball; for, if there is to be a new decentralized rural and small-town industry, that industry will have highway needs which have not entered into the past calculations of the highway builders.

Mechanization of industry

Now turn to another ball, mechanization of industry. It has recently attracted a great deal of attention; but before it was noticed it had been rolling to this collision for a hundred years and more. Steadily, through its course, it has been reducing the number of workers required to supply the daily wants of a static world. Steadily it has been releasing these workers to the things that have kept the world from remaining static. It released workers from agriculture to the service of a vast system of mechanized manufactur-

OLD TIMBER BRIDGE built in 1888 over South River in Maryland, replaced by modern concrete and steel structure 218.6 ft. long (1 mile including embankment approaches) and having a swing span with a 70-ft. channel opening.



ing industries. In turn, it released workers from the older manufacturing industries to new ones; to build an electrical industry, a chemical industry, a motor-vehicle industry. It will go on releasing men from works that can be reduced to routine to the doing of things that are new, that lead on and on out of the familiar into the imagined and into the now unimaginable.

So far as we are here concerned, what is most important about the effects of mechanization is that it has tended constantly to reduce the percentage of all workers required to supply our daily wants—producing the things that are called consumption goods—and to increase the percentage employed in producing the means by which the consumption goods are produced and distributed. We may, for convenience, lump all such means under the single name of plant; but it must be remembered that the name covers much more than the factories and their equipment, which we ordinarily think of as the manufacturing plant.

No small part of the manufacturing plant that we have been creating has been the cities themselves—the cities in which the forces of transportation and power have tended to confine manufacturing industry.

City growth and decentralization

That growth has come to an abrupt stop. The men that have been employed in creating it have been out of jobs. Take them all together and they make up a large part of the construction industry; and make no mistake about it, this depression will disappear when the construction industry is again active.

But that it will become active again in doing the same things that formerly occupied it is extremely unlikely. That it will go back to building big cities bigger is not in the cards. Remember those diffusive forces that are now at work.

What is much more likely, indeed certain, is that some of the men who have been building factories in large cities will shortly start building new and better factories in small towns, where overhead costs are lower, and where expansion is possible at something less than prohibitive cost. And some of the men who have been building homes and streets and waterworks in large cities will start doing the same things in small towns. Some of them, certainly, will find renewed occupation in the large cities; not probably in making them larger, but in making them better; in opening up their congested older sections; making them more habitable; adapting them to the altered conditions of modern existence for which they are badly fitted.

There will be men to do all these things and more; for remember, the ball of mechanization is still rolling. It will go on releasing men from routine tasks to the doing of new things; and the new things that will be done will be largely in rural America.

That is what concerns us most here. There has always been a frontier to absorb the released energies of mankind; and the frontier that will do that in the immediate future lies in undeveloped rural America and not in the overdeveloped large cities. To say that this will have profound influence on the highways—the highways that are the streets of rural America—is hardly to overstate the case.

Questions of the highway future

Having examined very briefly the past courses of economic forces and formed an impression of the nature of the effect their impacts may have upon the future course of development, let us now turn back more specifically to the highway.

We find that the customary highway revenues have dwindled during the depression. In property taxes the shrinkage has been great. In motor-vehicle taxes it has been small—and, incidentally, the smallness of this shrinkage has been one of the striking phenomena of the depression. At present the federal emergency appropriation roughly makes up the deficiency in yield of the other sources of revenue; it probably does no more.

It is significant that highway construction was the first and is continued as one of the most important works provided by the federal government for relief of unemployment. It is more significant that in the National Industrial Recovery Act the government has departed from its long-established policy of participating only in the improvement of the main interstate roads that constitute the federal-aid system, and has insisted on expenditure of a portion of the appropriation on secondary or feeder roads. And it is more significant still, and symptomatic of a future state of health for the country's transportation system, that attentive study is being devoted to the problem of discovering secondary roads.

In the face of these facts certain insistent questions are being asked by thousands of men: What of the future? Must property taxes be completely abandoned? Will the motor-vehicle taxes hold up? Can the federal government continue its support? Can the taxpayers stand more roadbuilding?

A forecast from facts

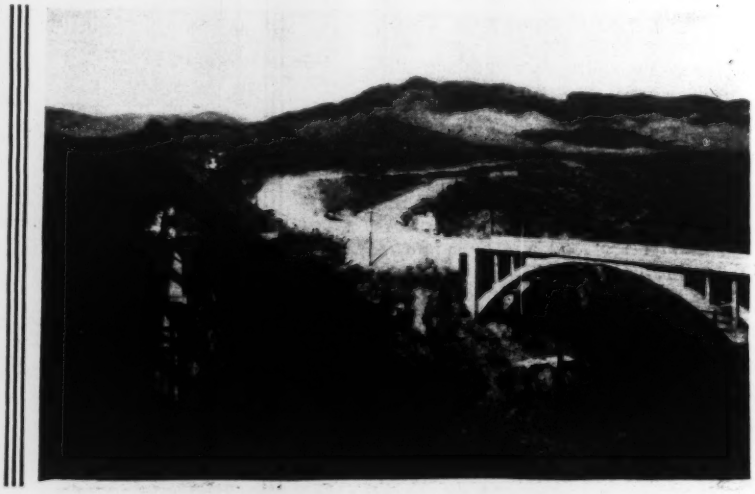
The future of the highways to a certain extent is so compellingly conditioned by the known facts of the present that no clairvoyant faculty is needed to envisage it. To that extent a forecast may be ventured.

1. No Highway Holiday—Most incapable of all is the assurance that we shall go on building highways. There will be no highway holiday—not, at any rate, until we are ready for a city-street holiday also.

2. Taxes and Road Control—There appears to be no strong reason for belief that the property tax will be permanently abandoned as a revenue producer for local roads. For such roads it accords closely with the character of the benefits accrued, and its retention is logical. Difficulty of collection should pass with the depression; decentralization of industry and a rural development beyond anything dreamed of a few years ago seem to be the probabilities of the immediate future, and they will bring the property tax back to its old reliability. In the meantime, popular demand for relief from tax burdens may accelerate the tendency toward transfer of control over local roads to state administration.

3. User Charges Will Grow—Motor-vehicle taxes will be increased in states in which rates are now low. There will be no permanent shrinkage in total yield, but on the contrary a consider-

RELOCATION of old road gives a straightaway approach with a long sight distance to the new Cienga Bridge on an improved state highway near Tucson, Ariz.



able increase, taking the country as a whole. It is significant that already the automotive industry leads in the recovery.

4. Federal Aid to Continue—The federal government not only *can*, but *must* continue its support. While unemployment lingers, the federal contribution is likely to remain high.

5. State Administration—Transfer of complete responsibility for all rural highways to the state highway departments is to be expected in all states. Efficient administration will require adequate financing and state-wide traffic surveys in all states. The more nearly such surveys take on the character of general rural planning the more likely are they to supply the information that will be the imperative need of the immediate future. It has been possible to plan and carry out the pioneer improvement of inter-city highways with a minimum of precise economic study. It will not be possible to deal efficiently with the marginal problems of the future without accurate knowledge of needs.

6. Planning Essential — Long-time planning and continuity of administration will be imperative. The federal-aid system and state highway systems, as now designated, approximate an actual general-use system of primary importance. Errors of selection should be rectified as indicated by survey data. Rectification will be simplified when the local roads pass under state control. But continued pressure toward real traffic adequacy of the primary general-use system must remain a secure item in the highway budget. It will be the duty of administrative officials to resist unwise diversion of funds required for that purpose to gratify ill-considered demands for unduly rapid local-road improvement.

7. Operating Requirements — Complete traffic adequacy of primary general-use highways will not be reached until economically maintainable, dustless, all-year surfaces, designed to resist the maximum loads that may be expected to be applied with significant frequency, have been laid on the entire mileage; and, further than this, until the width of surface, curvature, sight distance, intersections, and grades have been brought to safe standards, consistent with vehicular operation at the maximum probable speed. At present even the least of these requirements—a maintainable surface of adequate strength—has yet to be realized on a large part of the recognized mileage of general-use highways. The further refinement to complete adequacy is, for the most part, still ahead.

8. Access and Bypass Routes—The construction of the general-use routes into and through the cities and of alternate bypass routes around them is also very largely still in the future and urgently pressing.

9. Increased Width Needed—Anticipating a quick acceleration of rural development, it will be realized that satisfaction with right-of-way width sufficient only for the minimum requirements of present construction is a penny-wise, pound-foolish policy. Federal insistence upon provision of widths consistent with ultimate requirements on roads built with emergency funds will lead to general realization of this important need.

10. Ditches and Shoulders — The roadside ditch will be recognized as a hazardous anachronism and will quickly disappear, supplanted by underground drainage. In the space it formerly occupied footpaths will be provided where density of pedestrian and vehicular traffic requires.

Fill and cut slopes will be flattened and grassed over, and the cost of flattening will be saved by reduction and almost complete elimination of the necessity for guard-rails.

11. Roadside Care—Roadside landscaping, naturally and sensibly designed to restore and maintain an appropriate natural state of rural beauty, will be accepted as essential to a complete highway improvement. Not for esthetic reasons only, but equally for reasons of safety and traffic convenience, the roadside filling-station and lunch stand will be forced to submit to regulation by public authorities.

12. Crossings—Separation of highway and railroad grades at intersections will proceed at an accelerated pace. Narrow and unsafe bridges will be replaced by adequate structures.

13. Trucking Roads to Come—On routes where density of motor-truck traffic has reached the point where the truck tax payments will pay the cost (on the average about 1,500 trucks a day), separate roadways will be provided for truck traffic only. On routes where the density of truck traffic is high, but less than the density necessary to pay for separate roadways, additional surface width may be provided. Motor truck and bus taxes, where now inadequate, will be adjusted to cover all extraordinary highway costs entailed by truck and bus operation, in addition to a pro-rata share of normal highway costs.

14. Local Roads for Rural Development—If the wiser counsel prevails, there will be no construction of excessively elaborate, economically unwanted transcontinental boulevards. A far grander project is ripe for beginning—the planned improvement of the more important local roads in anticipation of a rural development exceeding anything yet seen or imagined, which seems to be the inevitable goal of new economic forces now at work.

* * *

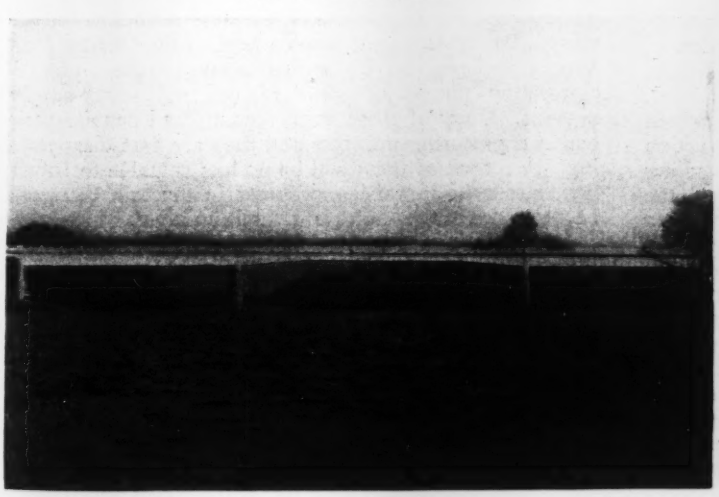
Thus, the conclusions from our survey of the facts may be thus condensed:

We shall go on building highways; there will be no highway holiday. The property tax will continue to finance local land-service roads, while motor-vehicle taxes, increased in states in which rates are now low, will provide revenue for improvement of main roads. The federal government also will continue its support.

Transfer of complete responsibility for all rural highways to state highway departments is to be expected in all states. Long-time planning and continuity of administration are increasingly important. Real traffic adequacy of the primary, general-use highway system must remain a secure item in the highway budget, for a maintainable surface of adequate strength has yet to be realized on a large mileage of general-use highways.

And finally, refinement of the road as an engineering structure able to give safe and full service must be persistently striven for. It has not yet been attained.

STEEL CANTILEVER BRIDGE with a 190-ft. center and 150-ft. anchor spans all of deck plate girders, with concrete slab deck, built across Pearl River at Columbia, Miss.



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January 18, 1934

Public Works in the Budget

AGAINST ALL expectations, no new appropriations for public-works projects were asked of Congress by the President in his budget. This does not mean that the objective of the public-works section of the Recovery Act has been abandoned. It is true that less than half of the three billion dollars provided by that Act has been put under contract, that the effect of the expenditures made possible under that Act will not be evident until spring, and that the money will not all be spent until the fiscal year 1935-'36. But the money all has been allocated and the Public Works Administration has not relaxed its efforts to get states and municipalities to apply for funds for needed projects. The conclusion, therefore, is inescapable that the President expects to have more money made available for such work, and that his omission of it from the budget simply is a strategic move. He knows that more money must be provided to maintain the momentum of recovery. But he knew also when he wrote his budget message that both Congress and the country would be appalled by the necessary size of the budget and that a request for more emergency funds would have been psychologically bad. With confidence he could look forward to a demand upon Congress from all parts of the country for money to keep the work going. Even as we write there come proposals from influential groups in Congress for another two to five billion fund for public works, and the force of logic behind them appears strong indeed. At present outlook, therefore, little doubt exists that the PWA program will continue through another year.

Better Forms

THE STEADY DECREASE in construction volume during the last few years has not checked development of the technique of the art. A prominent instance is improvement of concrete form design. In the past the building of forms was often left entirely to the carpenter foreman, a system that usually resulted either in heavy, uneconomical units or in skimpy forms that left behind them a wake of sagging and bulging concrete lines. Form building today is an engineering problem, which receives as much attention as any other construction operation. Economy, adequate strength, ease of handling and a smooth surface are the prime requisites of the modern concrete form. With steel admirably meeting these requirements, great advances have been made in the development of the steel form. Much credit for this advance is due the construction-equipment manufacturers, who have put real engineering skill into the design of their products. The use of steel forms is spreading from the popular fields of tunneling, sewer building and road work into more specialized and intricate installations. Special surfacing for wood-frame forms is another development that deserves commendation. Plywood, composition board and metal sheets for surfacing have improved forms greatly, giving economy, multiple-use value and a smooth concrete surface. Greater credit than is usually given is due the modern form for the excellence of present-day concrete construction.

A Note of Caution

GRADUAL ACCUMULATION OF DATA on methods of analyzing structural design to provide earthquake resistance warrants a word of caution as to the hazard of their wholesale acceptance by those not conversant with the fundamental vagaries of the subject. A full understanding of the assumptions that must be made is essential to proper use of the data. The effects of earthquake forces on structures have been studied for years, and today solutions are available which for specific load conditions will provide answers of reassuring definiteness. However, it is of the utmost importance that those using such analyses appreciate their limitations. Back of all earthquake analyses—and the same applies to wind problems in lesser degree—must be an assumption, or series of assumptions, as to the force and its characteristics. In the case of earthquakes this includes such factors as the velocity and amplitude of the earth wave, its direction and duration, and only for these particular conditions is the analysis valid. No one appreciates this condition better than those who have made serious study of earthquake conditions, and it is not to these that a caution needs to be addressed. Others who may be tempted to use the new knowledge available on earthquake-resistant design should face the fact that it is still strictly limited by its assumptions as to forces.

Records of Structures

MAKING A DETAILED RECORD of all buildings of historic interest, as the Civil Works Administration has undertaken, corresponds to the special U. S. Coast & Geodetic Survey work, which is expected to provide work for engineers; and while it may not be of as direct utilitarian value as extending the survey network it will nevertheless have great historic value. If time and the available funds permit, the record taking should be extended beyond buildings of historic value; it should include notable old bridges, canal locks, dams, power and pumping plants and other structures of an engineering nature. The nation should have a permanent record of the details of such structures as the Brooklyn Bridge and the Eads Bridge at St. Louis, as well as of the few remaining wooden bridges, of the D.&H. Canal aqueduct at Lackawaxen, Pa., of the great water wheel of the Burden Iron Works at Troy, N. Y., and of some of the large reciprocating pumps of some of our old water-supply systems. Many of these structures marked definite periods in engineering progress and they are fast disappearing. A record of them will be no less valuable to future generations in appraising progress in the past than will be the record of the homes and public buildings of the past.

Bidding for Services

DESPITE THE POWERFUL INFLUENCE of publicity and educational effort by engineers and their societies, cities continue to ask for bids for engineering services. Such an advertisement appeared Jan. 11 in a daily paper of Peru, Ill., for *"any person who may desire to do all of the civil engineering for the city."* Sealed bids are to be submitted to the city clerk on Feb. 2 at 7:30 p.m., ac-

cording to the notice signed by the board of local improvements, though it was the city council which directed that bids be taken. The Illinois Society of Engineers, meeting in Springfield during the very week of the bidding, evidently has one piece of business to attend to that did not find advance place on its program.

Technical Language

WHAT DOES the non-technical man think about when he overhears the shop talk of engineers? There is little doubt that he accepts as unavoidable and therefore proper those terms that are utterly foreign to his vocabulary, like "modulus of elasticity" or "hydrogen-ion concentration." But those composed of familiar words that throw off their accustomed meaning are likely to be disturbing. What mental image, for example, is conjured up for him by the term "bending moment"? Certainly not that of a structural member subjected to flexure. He may envision some Einsteinian mad-land in which time and space are hopelessly tangled. "Moment of inertia" probably recalls to him the climatic knockout finish of the last major prizefight, while "influence line" reminds him of the time he asked his politician friend to have his traffic-violation ticket "fixed." And surely his attempt to read some meaning into the puzzling "loss of head" of the hydraulic engineer is apt to involve mental pictures of Ichabod Crane on a dark night, or of Louis XVI on an unpleasant day in Paris; especially as "loss of head" is measured in feet. Technical language at its best is not a favorable medium for the information of the layman; the more reason why engineers today, when engineering works are so much in the public mind, should cultivate clearness if they wish to gain and hold the essential public support.

CWA Pay for Engineers

THE SPIRIT back of the President's order setting up the Civil Works Administration is being violated in many places in the rates of pay set for engineers. The CWA was not to pay uniform relief rates just sufficient for the meagre necessities of life, but it was to pay real wages, something comparable with those a man could earn under normal conditions.

As a basis, the so-called PWA rates were taken as a guide. These range from 40 to 50 cents an hour as a minimum for unskilled and from $1 to $1.20 for skilled labor. Under such a plan it was to be expected that engineers would be paid at least the minimum for skilled mechanics, with higher rates for those in supervisory or highly responsible positions. But no, the rates paid quite generally are those of the unskilled or semi-skilled laborer. Protests, with few exceptions, have been without result; the usual reply from CWA officials is that "they have no authority to pay higher rates." The exceptions, however, indicate that what they lack is guts, not authority.

What is needed most to correct this situation is group action by the engineering profession. The profession should make its voice heard both locally and in Washington. American Engineering Council acted on this subject last week, and it is expected that the American Society of Civil Engineers will act this week. Several local societies also have acted. Others should do likewise. Protest should be made against the general principle involved and against specific rates paid.

If a precedent is not to be established, concerted action is needed while the CWA is still young. There are many indications that its life will not be as short as first indicated, and if engineers are to be decently paid through the remainder of the period their rates must be fixed now while such matters are in a state of flux.

Grade-Separation Policies

A PROGRAM of grade separation of railway-highway crossings offers the largest opportunity at hand for a countrywide program of quick employment on essential, constructive work—a truth that has been stated more than once in these columns during the last six months. The recovery agencies, however, and specifically the Public Works Administration, have ignored the grade-separation possibilities in favor of long-range federal projects on the one hand and municipal-loan undertakings on the other. Thus a large potential volume of employment has been lost and productive power wasted in idleness, while the hazards of dangerous grade crossings were perpetuated.

There is a fundamental policy difficulty in the way of action on grade crossings. Established principle with respect to grade separations divides the cost between the railroad and local governments, both of which under present conditions are unable to finance extensive operations of the kind. At no time was federal responsibility for carrying out such improvements recognized until last summer, when the Recovery Act made a modest allocation to grade crossings. To proceed from this initial recognition onward toward a definite policy under which the improvement of dangerous grade crossings would be made a national undertaking is a long step, and one of serious import. But we hold that the time is at hand when this step should be taken and, in the interests of the country as a whole, must be taken.

Railroad revenues at present are inadequate to carry the properties. In due course they will again suffice to meet the costs of operation, maintenance and capital. It will be much longer, however, before railroads can again make large investment in non-productive improvements. Grade separations, which bring no revenue to the railroads, will therefore be economic impossibilities for a good many years.

As matters stand today, the cost of separations must be earned from rate income, which the public provides—or from other public moneys. The cost to the public will be quite the same in either case; but in the former no grade-separation work can go forward until some favored future day, while in the latter case many of the most urgent separations can be built now, with tremendous gain to employment of idle workers and stimulation of business.

These conditions, in our judgment, warrant immediate consideration of a courageous new policy on the part of the government, through which the elimination of the most dangerous grade crossings will be placed in preferred position on the roll of recovery public works. Plans are ready for immediate construction of at least a hundred million dollars' worth of separations, and under a vigorous new policy much more can be made ready in a few months. With such an employment resource within reach, and with its convincing value as a means of bringing about an essential betterment of safety conditions, shall ancient tradition stand in the way of constructive new policy?

CURRENT NEWS

St. Lawrence Treaty Lacks Needed Votes To Pass the Senate

Washington Correspondence

THE St. Lawrence treaty lacks the two-thirds vote necessary for its ratification by the Senate. The President recently sent to Congress a message advocating the combined power and waterway project although Robert F. Wagner and other Senate Democrats had served notice that on this issue they would not follow their leader. Though many weeks of recurring debate are in prospect, it is evident that 64 votes can't be counted for the treaty as informal polls indicate that an actual plurality is in opposition.

With the Tennessee Valley development program in the southeast, Boulder Dam in the southwest, and the Columbia Basin projects in the northwest, President Roosevelt in his message stressed the benefits to the nation of bringing the St. Lawrence in on the northeast to complete the four corner stones of a vast public power supply.

But the President has washed his hands of the treaty now. His campaign pledge is fulfilled, and his genuine enthusiasm is tempered by the fact that it is the first proposition on which he does not have the united support of his party. And after all, the St. Lawrence seaway was President Hoover's dream and in this light President Roosevelt regards it in much the same way as Mr. Coolidge regarded Mr. Harding's World Court.

Reservations, particularly with respect to the diversion of more water into the Mississippi, might go far to mollify opposition, but it is doubtful whether the President would accept such reservations because of his expressed conviction that this would not be playing fair with Canada.

As chairman of the Committee on Foreign Relations, Senator Pittman of Nevada presented the treaty to the Senate with an eloquent address that was interrupted by heckling from both sides of the aisle. Opponents were well-armed with a minority report by Senator Wagner which asserts that the project would cost $573,000,000 rather than $272,000,000, that it has been outmoded by a new economic trend defined in the decline of export trade, that the waterway would neither relieve traffic congestion nor compete effectively with the railroads, that taxpayers would be assessed 15 cents for every bushel of grain, saving the shipper 2c. now and 4.5c. in normal times, that power development, although unquestionably desirable, favors Canada unduly and should not be hampered by association with an extravagant navigation project. Senator Wagner's carefully prepared report estimates that as compared to $483,000,000, the cost of the navigation project alone, $260,000,000 would build and equip a rail line of 1,033 miles from Chicago to Boston with a yearly traffic capacity three times that of the waterway.

Muir and Pirnie Resign as NRA Deputy Administrators

Malcolm Muir, division administrator of the National Recovery Administration and one of the chief aides of General Johnson since the inception of the NRA, resigned on Jan. 9 to devote his full time to his duties as president of the McGraw-Hill Publishing Co. The following day Malcolm Pirnie, deputy administrator under Mr. Muir, also resigned in order to return to his practice as a consulting engineer in New York. Mr. Pirnie has served as a deputy administrator in Washington for the past six months. Among his responsibilities have been the code for the construction industry and the many supplemenal codes.

Mr. Pirnie was active in the development of public works for financing under the relief act of 1932 and the recovery act of 1933, previous to his assignment as a deputy administrator, both as president of the American Water Works Association and on the executive committee of the Committee for Trade Recovery.

PWA Requires Denver to Vote on Moffat Water Tunnel Plan

While the PWA is agreeable to supplying funds for the Moffat water tunnel diversion project for Denver, Col., on the leasing plan it requires that a referendum first be held. A special election is to be held Jan. 23, at which time bond issues for a sewage-disposal plant, bridges, flood control and river protection on the South Platte and Cherry Creeks will be voted upon.

The amount of the various issues is as follows: For the Moffat tunnel work, $3,500,000; sewage disposal, $1,600,000; Cherry Creek retarding dams for flood control, $295,000; Alameda Ave. bridge, $40,000; Champa St. bridge, $32,000; Stout St., $27,500; walls and embankments along Platte River, $590,000; flood control walls Cherry Creek in town, $110,000. All of the above figures are 80 per cent of the total cost. An additional bond issue for $1,000,000 is proposed for tools and materials for use in the CWA or PWA programs or an independent work project or even for direct relief.

American Engineering Council Changes Its Administrative Head

WITH renewed pledge of support from its members, American Engineering Council elected new leaders at its annual meeting in Washington Jan. 11-13. John F. Coleman, consulting engineer of New Orleans and past president of the American Society of Civil Engineers, was elected president and Frederick M. Feiker was elected executive secretary, succeeding Lawrence W. Wallace, who retires to become vice-president in charge of the Washington office of the W. S. Lee Engineering Corporation.

The roster of new officers representing the several national and local engineering societies is as follows: Vice-presidents: C. O. Bickelhaupt, vice-president of American Telephone & Telegraph Co., New York, representing the American Institute of Electrical Engineers; Paul Doty, consulting engineer of St. Paul, representing the American Society of Mechanical Engineers; A. J. Hammond, consulting engineers of Chicago, representing the American Society of Civil Engineers; and W. H. Woodbury, Duluth, representing the local engineering societies. C. E. Stephens, of the American Institute of Electrical Engineers, was elected treasurer, and William McClellan, president of Potomac Electric Power Company of Washington, D. C., was elected chairman of the finance committee.

Federal utility competition

Policies of the Roosevelt administration were the principal topics of discussion at the meeting. Concerning the allotment of federal funds to finance municipal waterworks, electric light and power plants which duplicate or destructively compete with existing plants, a committee was appointed with Mr. Coleman as chairman to draft a letter to President Roosevelt suggesting that a public announcement that loans will not be made for unnecessary competitive services would restore confidence of the investing public in the stability of their public utility investments and would result in a considerable increase in employment and in the purchase of materials for extensions and additions to existing privately owned and operated services.

A resolution of the same tenor adopted by the administrative board last October drew from Harold L. Ickes, Administrator of Public Works, the following reply:

> The Public Works Administration will make loans for municipally owned power plants when such projects are sound from a social, economic and engineering point of view. The question of public policy is for the municipalities to pass upon. Each project will be judged on its merits, just as any other project would be. Whether a proposed municipal power plant would enter into competition with an existing plant is a factor to be taken into account but the circumstance of possible competition would not of itself prevent a grant.

Engineers on Civil Works

Council deplored evidence that political influence is necessary in some quarters for engineers to obtain employment under the Civil Works Administration. Present inequalities in wages where engineers and unskilled laborers are engaged on the same projects also was criticized.

Reports that transfer of the Coast & Geodetic Survey from the Commerce to the Navy Department is contemplated prompted Council to oppose the proposal as begging the question on its recommenda-

tion in 1921 for unification of all government agencies of this or similar character in a Board of Surveys and Maps. It was also represented that transfer of the Coast Survey at this time would interfere with its emergency program.

Council's executive staff was instructed to use its good offices, in conjunction with the American Institute of Consulting Engineers to protect the interests of engineers as they may be affected by the Federal Securities Act. Edwin P. Wendt declared that the law exposes engineers to blackmailing suits and that it is doubtful whether this condition can be altogether eliminated.

Change in secretaries

The resignation of L. W. Wallace as executive secretary, presented to the executive committee some weeks ago, was accepted by the administrative board, effective immediately. Mr. Wallace has been executive secretary of Council since 1921, the Council having been organized late in 1920, and since that time he has been responsible for the formulation of numerous reports issued by Council and has directed its activities in Washington. Mr. Wallace is a mechanical engineer, a graduate of Texas A. & M. College and of Purdue University. Following graduation he was professor of railway and industrial management at Purdue University and in 1919 became assistant general manager, Diamond Chain & Mfg. Co. at Indianapolis. From 1919 to 1921 served as director of the Red Cross Institute for the Blind at Baltimore.

Frederick M. Feiker, the new executive secretary, is an electrical engineer, a graduate of Worcester Polytechnic Institute in 1904. Soon after graduation he went into editorial work, becoming editor of *Factory* in 1906 and subsequently chairman of the editorial board of the A. W. Shaw Co. of Chicago. From 1912 to 1915 he was editor of *Electrical World* and subsequently acted as a vice-president of the McGraw-Hill Publishing Co. In 1920 he was given leave of absence to become assistant to the Secretary of Commerce and later special agent for the Bureau of Foreign and Domestic Commerce. From 1923 to 1926 he was operating vice-president of the Society for Electrical Development and since 1927 has been managing director, Associated Business Papers, Inc.

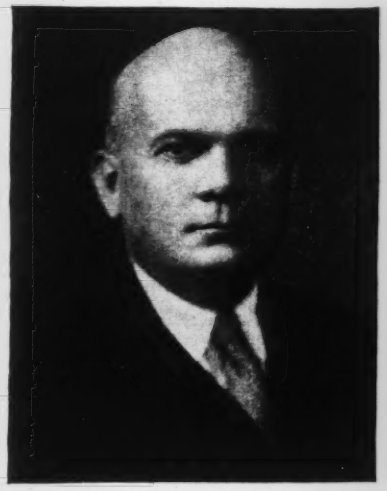
Policies of council

Mr. Coleman, the new president of the Council, outlined the function and purposes of the organization in the following statement to a representative of *Engineering News-Record*.

"The primary purpose of the existence of American Engineering Council is the establishment of facilities at the seat of government through which such aid as the engineering profession collectively may be qualified to render to the government, its departments and bureaus may be more readily available. With headquarters of Council at Washington, its officers may be kept informed as to the program of events, and may the more readily tender such service as it is qualified to perform.

"The experience of the past thirteen years of the existence of Council has developed an ever-increasing recognition of its qualifications to be of service. Its suggestions and assistance have often been sought on technical questions by department heads and by members of the congress. With membership of its constitutent organizations aggregating well over 50,000 which includes engineers of highest qualifications, the material available for standing and special committees is without parallel and is frequently called into use.

The program for national development now so actively under way concerns intimately the development of resources and industries. In many respects this brings



Lawrence W. Wallace

Retiring Executive Secretary of American Engineering Council

engineers and engineering into requisition. There are many ways in which American Engineering Council may be of aid. The engineer's part in the program of development not only has to do with the technical problems of engineering, but also with the determination of facts which will be of value to the administration in shaping its policies.

"There is ample evidence that opportunity exists for Council to serve both the Nation and the profession in ever increasing degree, and it is earnestly hoped that its officers may be able to fully grasp this opportunity."

Mr. Feiker said:

"It is evident that great opportunities lie before American Engineering Council to serve the vast program of national development. Already calls for information and advice in connection with many of these developments have so increased as to demonstrate the existence of an important need for the Council's work.

"In the articulated program of government action to assist in the development of natural resources and private industries, engineers are vitally concerned not only in technical matters but in respect to determining facts that will be of value in formulating policies. For example, the administration of many NRA codes will call for the best thought in shaping conclusions as to obsolescence, measure of plant capacity, and elimination of waste; to this work the Council can contribute. Similarly, regional development, national planning, the public-works program and other major developments call upon engineering knowledge and analysis.

"It is in this way that the Council will seek to go ahead during the coming year. This service will be limited only by the resources made available to it to carry on its activities."

O. L. Chapman of PWA Board to Speak at A.R.B.A. Meeting

Oscar L. Chapman, assistant Secretary of the Interior and executive secretary of the special board for public works, is to be the principal speaker at the annual banquet of the American Road Builders Association to be held at the Stevens Hotel, Chicago, during the week of Jan 22.

As executive secretary of the special board for public works, Mr. Chapman is in close touch with the PWA program and especially with the administration of the highway work being carried out as part of that program.

Thomas H. MacDonald, chief of the Bureau of Public Roads, will address the opening general session of the association on the national government's activities and plans for expansion of the highway program. Other speakers include E. B. Jeffress, chairman, state highway commission, of North Carolina; Roy W. Crum, director, Highway Research Board; O. S. Warden, chairman, Montana highway commission, and president of the American Association of State Highway Officials; Donald C. Stone, director of research, International City Managers Association; Frank D. Chase, director and chief engineer for the CWA in Illinois; G. J. Kane, chief engineer for the CWA in Ohio, and Preston G. Peterson, state highway commissioner of Utah.

Toll Bridge Purchases Authorized in Pennsylvania

A series of bills authorizing the state of Pennsylvania to purchase toll bridges and to convert them into free bridges after the purchase loans are paid off have been approved by the governor of Pennsylvania. The state treasurer is authorized to borrow up to $10,000,000 to be used by the highway department to purchase bridges. After purchase the department will operate the bridges as toll bridges until the revenue, less operating expenses, is sufficient to retire the bonds, when the bridges will become free. One of the bills authorizes the state to accept federal funds to be used for the construction of highway bridges. The highway department has recommended the construction of bridges across the Susquehanna river at Millersburg, McCalls Ferry dam, and either at Middletown or Bainbridge.

Prequalification of Bidders Begun on Ohio Highway Work

All prospective bidders on highway work in Ohio will be required to submit evidence of their financial qualifications to the State Highway Department after Jan. 15. This action by the Highway Department has been taken in conformity with a law recently enacted which permits the department to require prequalification.

On contracts of $50,000 or less, the department requires the bidder to show that he has available at least 15 per cent of the contract price in cash or current assets, and on contracts exceeding $50,000, the bidder is required to have 15 per cent of the first $50,000 and 10 per cent of the balance.

DETAILS OF PWA LOANS AND GRANTS FOR NON-FEDERAL W ORK

LIST NO. 39

LOCALITY	LOAN AND GRANT OR GRANT	TYPE	AMOUNT
Lemar Grove and Spring Valley Irr. Dist., San Diego, Calif.	L. & G.	Pipe Line	$600,000
Indianapolis, Ind.	L. & G.	Sewage Disposal	395,000
Portsmouth, Ohio	L. & G.	Sewers	85,000
Fort Mills, S. C.	L. & G.	Sewage System	85,000
State of Oregon	L. & G.	Bridge	711,000
Goshen, Ind.	L. & G.	Waterworks	150,000
Spanish Fork, Utah	L. & G.	School	250,000
San Francisco, Calif.	L. & G.	O'Shaughnessy Dam	3,500,000
McArthur, Ohio	L. & G.	Sewage System	47,000
Carolina Beach, N. C.	L. & G.	Waterworks	50,000
San Francisco, Calif.	L. & G.	Airport	260,000
McArthur, Ohio	L. & G.	Waterworks	56,000
State of Massachusetts (Amended)	L. & G.	Highway	97,000
Cologne, Minn.	L. & G.	Waterworks	14,000
Taunton, Mass.	L. & G.	Sewer	103,000
State College for Negroes, Petersburg, Va.	L. & G.	Dormitory	262,000
State of Oregon	L. & G.	Bridges	3,384,000
State Teachers College, Harrisonburg, Va.	L. & G.	Dormitory	140,000
Snohomish County, Wash.	G.	Paving	5,000
College of William and Mary, Williamsburg, Va.	L. & G.	Buildings	650,000
State Teachers College, Fredericksburg, Va.	L. & G.	Dormitories	360,000
Rockwall, Texas	L. & G.	Waterworks	35,000
Cedartown, Ga.	L. & G.	School	17,000
Medical Lake, Wash.	G.	Hospital	36,000
Tacoma, Wash.	G.	Sea Wall	18,000
State of Oregon	L. & G.	Bridges	1,008,000
Indianapolis, Ind.	G.	War Memorial	192,000
Fort Sumner Irr. Dist., N. M.	L. & G.	Irrigation	150,000
Alameda and Contre Costa Counties, Calif.	G.	Highway & tunnel	1,000,000
Iowa City, Iowa	L. & G.	Sewage system	516,000
Virginia Military Inst., Lexington, Va.	L. & G.	Buildings	360,000
Los Angeles, Calif.	L. & G.	Schools	9,380,000
State of Massachusetts, West Concord	L. & G.	Dormitory	170,000
State of Massachusetts, Westfield	L. & G.	Armory	163,500
State of Massachusetts, Ware	L. & G.	Highway	47,000
State of Massachusetts, Westborough	L. & G.	Hospital	29,000
State of Massachusetts, Wrentham	L. & G.	Buildings	98,000
Phoenix, Ariz.	L. & G.	Park Development	915,000
State of Massachusetts, Dovers	L. & G.	Hospital	119,000
Bakersfield, Calif.	L. & G.	Library	274,000
Inyokern, Calif.	L. & G.	School	11,000
Caldwell, Texas	L. & G.	Waterworks	32,000
Grant County, Wash.	G.	Road	4,000
Danbury, Conn.	L. & G.	Sewage System	200,000
Bristow, Okla.	G.	School	90
Marysville, Calif.	L. & G.	Hospital	75,000
Morgan Hill, Calif.	L. & G.	Waterworks	49,000
Modesto, Calif.	G.	Sewer System	2,000
Hibbing, Minn.	L. & G.	Municipal Utilities	1,035,000
Stearns, Ky.	L. & G.	School	9,000
Mansfield, Ohio	G.	Hospital	15,000
Manchester, Ga.	G.	Sewage Disposal and Waterworks	4,000
Clairton, Pa.	L. & G.	Sewer System	112,000
San Jose, Calif.	L. & G.	Auditorium	460,000
Modesto, Calif.	L. & G.	Courthouse	248,000
Taft, Calif.	L. & G.	Waterworks	80,000
Stanislaus County, Calif.	L. & G.	Hospital	250,000
Long Beach, Calif.	L. & G.	Fire Station	17,000
Gambria, Calif.	L. & G.	Waterworks	24,000
Long Beach, Calif.	L. & G.	Public Station	7,000
Knoxville, Tenn.	L. & G.	Elec. Distrib. System	2,600,800
Keene, N. H.	L. & G.	Waterworks	6,000
McKenzie County, N. D.	L. & G.	School	28,000
Sherburne, N. Y.	L. & G.	Schools	115,000
Franklin County, Pa.	L. & G.	School	80,000
Park County, Wyo.	L. & G.	Schools	90,000
Hanover County, Va.	G.	Schools	32,000
Hartington, Neb.	L. & G.	Sewage Disposal	21,000
Mattituck, N. Y.	L. & G.	Schools	275,000
Chestertown, N. Y.	L. & G.	School	140,000
Otsego County, N. Y.	L. & G.	School	221,000
Parker County, Texas	L. & G.	School	7,000
Cayuga, N. Y.	L. & G.	Waterworks	38,000
Los Angeles, Calif.	L. & G.	Railroad	200,000
Henry County, Mo.	L. & G.	Schools	51,000
Oxford, Ohio	L. & G.	Sewer System	45,000
Dover, Del.	G.	School	9,000
Hot Springs, Ark.	L. & G.	Sewage Disposal	218,000
Walden, N. Y.	L. & G.	Sewer System	298,000
Brown County, S. D.	L. & G.	School	60,000
Greenburgh, N. Y.	L. & G.	Roads	370,000
Baxter Springs, Kan.	G.	Waterworks	2,000
Centreville, Md.	L. & G.	Sewage Disposal	33,000
Zeeland, Mich.	L. & G.	Waterworks	2,000
Ontario, Calif.	L. & G.	Sewer System	81,000
Monterey, Calif.	G.	Sewer	22,000
Hurlock, Md.	L. & G.	Sewer system	51,000
Chenequa, Wis.	L. & G.	Building	111,000
Chatham, Va.	L. & G.	Waterworks	15,000
Franklin, N. H.	L. & G.	School	33,000
Washington, Kan.	L. & G.	Waterworks	20,000
Hardwick, Vt.	L. & G.	School	13,000
Wahoo, Neb.	G.	Waterworks	19,000
Augusta, Kan.	G.	Power plant	6,000
Hamilton County, Ohio	G.	Water main	3,000
Crystal Falls, Mich.	G.	Water tank	3,000
Central, S. C.	L. & G.	Waterworks	62,000
Oakland, Calif.	G.	Sewer System	300,000
Shagway, Alaska	L. & G.	Water System	40,000
Fair Haven, N. J.	L. & G.	School	86,000
Mecklenburg County, N. C.	L. & G.	Schools	438,000
Hartford, Conn.	L. & G.	Paving	500,000
Salina, Kan.	G.	Sewers	8,000
Epping, N. H.	L. & G.	Waterworks	$40,000
Columbus, Mont.	G.	Water mains	3,000
Matoaka, W. Va.	L. & G.	Sewer	10,000
Cooper, Texas	L. & G.	Water and Sewer System	30,000
Globe, Ariz.	L. & G.	Waterworks	68,000
Lexington, Ky.	L. & G.	School	297,000
Sioux City, Iowa	L. & G.	Sewers	550,000
Reynoldsville, Pa.	L. & G.	City Hall	24,000
Gilmore City, Iowa	L. & G.	School	28,000
Gary, S. D.	L. & G.	Water tank	5,000
Belmond, Iowa	L. & G.	Water system	16,000
Garfield County, Wash.	G.	Highway	10,000
State of Washington	G.	Channel work	3,000
State of Nebraska, Lincoln	G.	Dormitory	13,000
Irvington, N. Y.	L. & G.	Waterworks	42,000
Boston, Mass.	L. & G.	Sewer system	1,000,000
State of Massachusetts, (Norfolk)	L. & G.	Hospital	87,000
Boston, Mass.	L. & G.	Streets	1,000,000
Boston, Mass.	L. & G.	Hospital	1,500,000
State of Massachusetts Bridgewater	L. & G.	Sanitary facilities	24,000
Shirley, Mass.	L. & G.	School	30,000
Teachers College, Terre Haute, Ind.	G.	School	98,000
Clear Lake, S. D.	L. & G.	Waterworks	10,000
Sardis, Miss.	L. & G.	Waterworks	21,000
Thurston County, Wash.	G.	Paving	3,000
Portales, N. M.	G.	Schools	4,000
Dighton, Kan.	L. & G.	Sewer System	59,000
Quainter, Kan.	L. & G.	Waterworks	7,000
Magnolia, Del.	G.	School	19,000
Minneapolis, Minn.	L. & G.	Sewage treatment	11,525,000
St. Paul; Minn.	L. & G.	Sewage treatment	6,521,000
Clay County, Kan.	G.	Road	2,000
Fox Point, Wis.	G.	School	24,000
Washington County, Okla.	G.	Road	1,000
Pueblo, Colo.	G.	Waterworks	11,000
Los Angeles, Calif.	G.	School	6,000
Lompoc, Calif.	G.	Waterworks	5,000
Los Angeles, Calif.	G.	Schools	24,000
Huntington Park, Calif.	G.	School	7,000
		Total	$58,250,500

LIST NO. 40

LOCALITY	LOAN AND GRANT OR GRANT	TYPE	AMOUNT
Sandy City, Utah (Increase)	L. & G.	Waterworks	$3,000
East Brunswick, N. J. (Increase)	L. & G.	Water Mains	15,000
Poulsbo, Wash. (Increase)	L. & G.	Sewer System	3,432
Cincinnati, Ohio (Decrease)	G.	Water Mains	569,400
Anderson, S. D.	L. & G.	Paving	101,000
Ellsworth, Me. (Reimbursement)	L. & G.	Sewer	32,000
Carrington, N. D.	L. & G.	Sewage Plant	27,000
Junction City, Ark. (Increase)	L. & G.	Waterworks	1,500
Victoria, Ark. (Increase)	L. & G.	Waterworks	5,500
Cincinnati, Ohio (Increase)	G.	Sewer	300
Canadian, Texas	L. & G.	Water System	31,000
Lodi, Ohio	L. & G.	Water System	17,000
Ottumwa, Iowa (Amended)	L. & G.	Bridge	265,000
Port Lavaca, Texas	L. & G.	Waterworks	54,000
Yankton, S. D.	L. & G.	Waterworks	39,000
Houlka, Miss.	L. & G.	Waterworks	32,400
New Cherokee, Iowa	L. & G.	School	37,000
Milnor, N. D.	L. & G.	Auditorium	16,400
Freedom, N. H.	G.	Water System	3,000
McPherson, Kan.	L. & G.	School	49,000
McLean, Ill.	L. & G.	Waterworks	45,000
Hampton, S. C.	L. & G.	Waterworks	40,000
Elsmere, Del.	L. & G.	Sewer System	60,000
Grand Saline, Texas	L. & G.	Waterworks	45,000
Stratford, Texas	L. & G.	Sewer System	28,000
Austin, Tex.	L. & G.	Waterworks	13,000
Cuero, Texas	L. & G.	Sewage Treatment	10,000
Memphis, Tenn.	L. & G.	Paving	74,000
Burlington, Wis.	G.	Sewage Treatment	9,000
Jefferson, Mo.	L. & G.	School	275,000
Greene County, Ill.	L. & G.	Drainage System	83,000
Poteet, Texas	L. & G.	Waterworks	12,000
Bridgeport, Texas	L. & G.	Waterworks	145,000
Richland Springs, Texas	L. & G.	Waterworks	30,000
Clark County, Wash.	G.	Paving	4,000
Pierce County, N. D.	G.	School	1,000
Florence, Ala.	L. & G.	Elec. Dist. System	412,000
Cook County, Ill.	L. & G.	School	31,000
		Total	$2,049,532
		Decrease (Cincinnati)	$569,400

LIST NO. 41

LOCALITY	LOAN AND GRANT OR GRANT	TYPE	AMOUNT
Macon, Ill. (Amended)	L. & G.	Waterworks	$20,000
Calhoun Falls, S. C.	L. & G.	Water System	72,000
Sellersville, Pa.	L. & G.	Waterworks	47,000
Thorsby, Ala.	L. & G.	Waterworks	29,000
Alameda & Contra Costa Counties, Calif. (Increase)	G.	Highway and Tunnels	95,000
Manitou, Colo.	L. & G.	Water Mains	18,000
Hanover, Pa.	L. & G.	Sewage Treatment	77,000
Hamilton County, Ohio	L. & G.	Sewer	356,000
Mcdesto, Calif. (Increase)	G.	Sewer System	100
Durant, Okla.	L. & G.	Sewer System	48,000
Lowell, Mass.	L. & G.	Paving	100,000
Centerville, Iowa	L. & G.	Sewage Treatment	27,000
Franklin, La.	L. & G.	Sewage System	177,000
Zachary, La.	L. & G.	Gas Line	16,000
Durant, Okla.	L. & G.	Waterworks	19,000
Granite, Okla.	L. & G.	Sewer System	51,000
Del Rio, Texas	L. & G.	Water System	77,000

Coast Highway and Park Projects Get PWA Loans

A GRANT of $1,095,000 to the Joint Highway District of Alameda and Contra Costa Counties in California to aid in financing a $4,234,000 highway and vehicle tunnel project at Oakland, and a combined loan and grant of $6,877,000 to the South Park Commissioners and the Lincoln Park Commissioners at Chicago for the construction of bridge approaches and a bridge over the Chicago River are among the large allotments of funds authorized by the Public Works Administration last week. Other loans include $782,000 for a school at Buffalo; $2,000,000 to complete the Allegheny General Hospital at Pittsburgh, a private loan; $2,000,000 to Denver for sewers and a sewage treatment plant; and $412,000 to Florence, Ala., for an electrical distribution system for power bought from the Tennessee Valley Authority. The grant to the highway district at Oakland, Calif., is for 2.8 miles of 40-ft. highway, grade separation structures and a 2,910 ft. twin-tube vehicle tunnel piercing the range of hills east of the city.

Details of the non-federal loans and grants are given in an accompanying table. List No. 39 in the accompanying table was given out among the loans noted last week but was not published in the Jan. 11 issue for lack of space.

One half of the PWA fund has been allotted to states, municipalities and other non-federal bodies according to the PWA. However, only $855,000,000 has gone into municipal and state projects, waterworks, sewers, streets, schools and other public buildings and facilities. The remainder is accounted for by other allotments including the $400,000,000 highway fund, $300,000,000 to the Civilian Conservancy Corps, $400,000,000 to the Civil Works Administration, $100,000,000 to the Federal Housing Corporation and $183,000,000 to the railroads.

Surveys and gaging

An allotment of $150,000 has been made to the Geological Survey for the installation of gaging stations and for the measurement of silt movements at points yet to be determined definitely, also $299,000 for mineral resources surveys and land classifications in 18 states.

The original allotment of $845,000 for the housing project of the Juniata Park Housing Corp., Philadelphia, has been increased by $200,000. This project is promoted by the American Federation of Hosiery Workers.

The allotment for the new mint at San Francisco has been increased from $780,000 to $1,225,000.

A sum of $1,000,000 has been assigned to the reestablishment of "certain agricultural and industrial works" in the Virgin Islands in such manner as to benefit the local sugar industry. The PWA announcement has hidden away in it the more enlightening statement that the reputation and good will is all that is left of the once flourishing rum industry of those islands. Evidently, it is to be reestablished.

Use of foreign products

The use of foreign asphalt has been permitted in order to save $900 on a $66,796 contract let by the Interior Department for grading and paving the Mall in Washington, D. C., between 3d and 7th Sts., and between 12th and 14th Sts., N. W. An announcement by the department stated that use of the foreign asphalt was permitted as an economy measure. The cost of the foreign product was reported to be $17 a ton and the domestic $6 higher. The award was made to McGuire & Rolfe, Washington.

Engineering Firm Name Changed

The name of W. S. Barstow & Co., has been changed to that of E. M. Gilbert Engineering Corp. to identify the organization with its president, E. M. Gilbert. W. S. Barstow & Co. was incorporated in 1906 to function as a centralized engineering, construction and management company for various utility companies. For many years the corporation has not only acted as engineers and constructors for new utility power plants and transmission lines, but also has acted as a general consultant to utilties in a wide variety of construction and operating problems. Except for the change in name, the corporation will continue its policies, personnel and management.

DETAILS OF PWA LOANS AND GRANTS FOR NON-FEDERAL WORK

LIST NO 41 (Continued)

Locality	Loan and Grant or Grant	Type	Amount
Lowell, Mass.	L. & G.	Sewers	140,000
State of California (Increase)	G.	Whittier Gymnasium	1,500
Siskiyou County, Calif. (Increase)	G.	School	900
Whittier, Calif. (Increase)	G.	Waterworks	200
Meriwether County, Ga.	L. & G.	Jail	13,000
St. Louis County, Mo.	L. & G.	School	150,000
St. Louis County, Mo.	L. & G.	School	45,000
Columbus, Ohio	L. & G.	Sewer System	793,000
Oakland, Calif. (Increase)	G.	Sewer Systems	6,000
Tucson, Ariz.	L. & G.	Waterworks	254,000
Helena, Okla.	L. & G.	Waterworks	17,000
Denver, Col.	L. & G.	Sewer System	2,000,000
Stoneboro, Pa.	L. & G.	School	25,000
Lawrence County, Pa.	L. & G.	Courthouse	768,000
Kingfisher, Okla.	L. & G.	School	44,000
Walpole, N. H.	G.	Bridge Repairs	9,000
Roberts County, S. D.	G.	School	5,000
State of Connecticut	G.	Highway	23,000
Raymondville, Tex.	G.	School	4,000
Los Angeles, Calif. (Increase)	G.	School	310
Los Angeles, Calif. (Increase)	G.	School	1,700
Santa Barbara, Calif. (Increase)	G.	Waterworks	300
Los Angeles, Calif. (Increase)	G.	School	4,000
Los Angeles, Calif. (Increase)	G.	Remodeling Bldg.	860
		Total	$5,534,870

LIST NO. 42

Locality	Loan and Grant or Grant	Type	Amount
Buffalo, N. Y.	L. & G.	School	$782,000
Mansfield, Conn. (Amended)	L. & G.	School	2,500
York, Neb.	G.	Sewer	6,200
South Park Commissioners, Chicago	G.	Bridge	4,934,000
Lincoln Park Commissioners, Chicago	L. & G.	Bridge	1,943,000
Colby, Ark.	L. & G.	School	222,000
Pittsburgh, Pa. (Private)	L.	Hospital	2,000,000
Choctaw, Okla.	L. & G.	School	66,000
Sussex County, Del.	G.	School	23,000
Fort Scott, Kan.	L. & G.	School	159,000
Mayville, N. D.	L. & G.	Waterworks	5,000
Stamford, Conn.	L. & G.	Bridges	284,000
Nederland, Texas	L.	Waterworks	8,000
Cook County, Ill.	G.	Roads	84,000
Tulsa, Okla.	G.	Bridge	47,000
State of Maryand, Annapolis	G.	Record Building	65,000
Montgomery County, Va.	G.	Schools	49,000
		Total	$10,679,700

LIST NO. 43

Locality	Loan and Grant or Grant	Type	Amount
Beach Grove, Ind. (Increase)	L. & G.	Sewers	$8,000
Orangeville City, Utah (Increase)	L. & G.	Waterworks	2,000
Warrenton, Ga. (Increase)	L. & G.	Water	1,500
Albion, Ind. (Increase)	L. & G.	Power & Water	3,500
Harmony, Minn.	L. & G.	Waterworks	39,000
Itawamba County, Miss.	L. & G.	School	7,000
Brigham City, Utah	L. & G.	School	175,000
Carbon County, Utah	L. & G.	School	293,000
Rice County, Minn. (Increase)	G.	Courthouse	5,500
Perry Town, Utah	L. & G.	Waterworks	8,000
Burlington, Kan.	L. & G.	Power	118,000
Lovell, Wyo.	L. & G.	Waterworks	140,000
Yankton, S. D.	L. & G.	City Hall	102,000
Browning, Mont.	L. & G.	Water System	15,000
Little Silver, N. J.	L. & G.	School	88,000
Custer, S. D.	L. & G.	School	55,000
Carlin, Nev.	L. & G.	Waterworks	100,000
Montvale, N. J.	L. & G.	Water System	21,000
Omaha, Neb.	L. & G.	Storm Water Sewer	906,000
Cape May, N. J.	L. & G.	Sewers and Boardwalk	125,000
Kenesaw, Neb.	L. & G.	Waterworks	13,000
Hanover, N. H.	L. & G.	School	185,000
Portsmouth, N. H.	L. & G.	Sewers	132,000
Dodge, Neb.	L. & G.	Waterworks	16,000
Sacramento, Calif. (Increase)	G.	Fire House	600
David City, Neb.	G.	Waterworks	4,000
Sacramento, Calif. (Increase)	G.	City Hall	3,300
Monterey, Calif. (Increase)	G.	Sewers	3,900
Hastings, Neb.	G.	Sewers	36,000
Choteau, Mont.	L. & G.	Water Mains	22,000
Ramsey County, N. D.	L. & G.	Auditorium	7,000
Hastings, Neb.	G.	Power	48,600
Hamilton County, Ohio	L. & G.	School	100,000
Buena Vista, Va.	L. & G.	Paving	10,000
Rising Sun, Neb.	L. & G.	Waterworks	15,000
Almont, N. D.	L. & G.	Streets	9,000
Keene, N. H.	L. & G.	Park Development	9,000
Concord, N. H.	L. & G.	Sewers	21,000
Pierce County, Wash.	G.	Bridge	4,000
State of Washington	G.	Roads	11,000
De Sota Parish, La.	G.	School	5,000
Kitsap County, Wash.	G.	Road	1,000
Kitsap County, Wash.	G.	Secondary Road	4,000
		Total	$2,872,900
		Grand Total	$79,387,592
Decrease in allotments previously announced			$ 569,400

Professional and Wage Matters Before A.S.C.E.

THE outgoing board of the American Society of Civil Engineers, at its meeting on Jan. 15-16 acted on many matters of professional interest, including the immediately interesting subject of low wages paid engineers under the CWA program, but turned over to the incoming board matters of policy determination including the society budget and the matter of its continued affiliation with American Engineering Council. Election of John F. Coleman, past president of the society, to be president of Council at its meeting last week is taken generally as an indication that the society will continue its affiliation.

Wages under the CWA

On the matter of wages for engineers under the CWA, the board, after receiving reports citing many instances of underpayment, appointed a committee with power to act on the subject, probably in conjunction with Engineering Council, but independently if that appears desirable.

A proposal from the Engineers Council for Professional Development that it be authorized to undertake a program of accrediting engineering schools was approved, as was the recommendation of the E.C.P.D. that the societies adopt a minimum definition of the functions of an engineer. An E.C.P.D. proposal that the four founder societies adopt uniform requirements for the several grades of membership was not approved but a committee of two was named to meet with like committees from the other societies to examine into the matter and report back.

The board voted to support the Institute of Consulting Engineers in its efforts to have the federal securities act modified as respects the engineers financial responsibilities in connection with projects on which he reports previous to the financing.

Federal departments

Transfer of the Coast and Geodetic Survey to the Navy Department, as now proposed, was opposed by the board. A proposal coming from the Los Angeles section that the President and Congress be urged to continue appropriations for the support of research carried on by the Bureau of Agricultural Engineering was approved. The present budget for the Department of Agriculture makes no provision for the continuation of this work.

Society representatives

John P. Hogan was named to represent the society as a member of the United Engineering Trustees; O. H. Ammann was named to Engineering Foundation; and Charles E. Trout to the Engineering Societies Library Board. A. E. Horst was appointed a member of the executive committee of the construction division.

The University of Mississippi was reinstated on the list of accredited engineering schools after being off the list for four years following a wholesale change in the teaching staff made by the Governor.

Vancouver, B. C. was selected as the place for the summer meeting, the date yet to be fixed.

Federal Housing Program Tied Up by Federal Red Tape

Legislation to define the rights and powers of the Federal Housing Corporation will be requested from Congress by Administrator Ickes of the Public Works Administration to overcome a ruling by Comptroller General McCarl which has prevented the corporation from functioning.

"We can't move a hand," said Administrator Ickes, "until the Comptroller General discovers that he isn't running the housing program. Negotiations to get him to loosen up have been going on for some time but he refuses to budge."

Mr. Ickes said he regards McCarl's ruling as a distinct violation of the President's executive order creating the corporation as an agency of PWA to expend $100,000,000 in housing and slum clearance projects. Council for PWA advised Mr. Ickes that under Mr. McCarl's ruling the corporation is helpless and, said Mr. Ickes, the most vital and important work that PWA should do must wait.

The controversy with the government's chief accounting official started when the housing corporation wished to advance small sums for options on property. The Comptroller General held that this would be illegal and also ruled that the Attorney General's office must examine all titles to property which the corporation desires to purchase. The organization expenses of the corporation that, according to Mr. Ickes, may have amounted to $150 were attacked by McCarl as impairing the $100,000,000 fund. Things went from bad to worse until, said Mr. Ickes, the Comptroller General had so hedged in the corporation as to usurp the duties of its officials. Mr. McCarl's attitude seems to be, said Mr. Ickes, that the framers of the Constitution had not contemplated that such a corporation should be set up and, therefore, that it cannot be done.

A bill defining specifically the powers of the corporation is being prepared in Mr. Ickes' office for introduction in Congress. The dispute does not affect projects which have been financed by PWA loans to limited dividend corporations.

Allotments announced Jan. 17 by PWA include $36,000 to the U. S. Bureau of Plant Quarantine for eradication of West Indian fruit fly from Key West; $92,000 to the Corps of Engineers for improvements at Olympia harbor, Washington, and $175,000 to the Bureau of Indian Affairs for hospital construction at Fort Thompson, S. D.

Argentine Floods Cause Damage to Many Engineering Structures

Dams, bridges, canal intakes and other engineering structures are reported to have been destroyed or badly damaged in floods that occurred in the Mendoza river valley in Argentina on Jan. 10. Accurate details of the flood and flood damage are not yet available, but according to cable reports to the New York *Times*, the flood was caused by the damming of the Tupungato River a few miles above its confluence with the Mendoza, the dam having been caused by ice broken off a glacier. Water from melting snow and from unusual rain held behind the ice dam until it gave way, swept down the Mendoza River, carrying away bridges of the Transandine Railway, dams and intake structures for irrigation canals supplying vineyards in the valley. Floods from other tributaries added to the damage in the low-lying areas.

Public Works Expenditures in the Federal Budget

Expenditure of $772,480,200 for federal public works during the present fiscal year ending July 1 next, compared with $481,870,192 last year, is anticipated by the new budget. Expenditures in the new fiscal year commencing July 1 are estimated at $508,904,800.

Estimates of actual out-go for public works this year and next are covered to a large extent out of "recovery funds" allotted by PWA but it is President Roosevelt's intention thereafter to apply $500,000,000 a year for a continuing program of federal public works.

The budget presented to Congress sets up estimated expenditures for construction by all government departments and agencies this year and next, compared with their actual expenditures in the year ended June 30, 1933.

CONSTRUCTION FIGURES IN THE FEDERAL BUDGET
(Figures given are in thousands)

Department	1935 Estimated	1934 Estimated	1933 Actual
Legislative	$1,254	$1,296	$5,237
	2,300	*498*	.....
Independent	1,818	5,512	18,309
	675	*1,190*	.....
Dept. of Agriculture	1,845	1,437	184,853
	38,227	*30,697*	.....
Dept. of Commerce	71	396	2,244
	1,471	*2,165*	.....
Dept. of Interior	1,098	6,916	34,072
	97,367	*49,364*	.....
Dept. of Justice	49	837	2,563
	.....	*980*	.....
Dept. of Labor	*163*	*1,260*	.....
Navy Dept.	115	2,925	12,626
	10,164	*14,954*	.....
Dept. of State	96	27	12
	650	*865*	.....
Treas. Dept.	15,441	89,032	109,992
	22,534	*11,174*	.....
War Dept.	9,637	58,342	103,325
	97,593	*177,198*	.....
District of Columbia	4,449	4,546	7,736
	887	*872*	.....
Total	$ 35,872	$171,265	$481,870
	$73,033	*601,215*	.....
	$508,905	$772,480	$481,870

Estimates of 1935 and '34 compared with actual figures for 1933, federal projects only. Emergency expenditures are in italics to distinguish them from the normal expenditures.

Codes and Federal Construction Subject of Contractors Meeting

Organization of the general contractors divisional code authority, a tentative survey of the policies of the PWA and CWA and their effect on the construction industry, and a study of the wage and labor policies of various governmental agencies are to be subjects for discussion at the 15th annual convention of the Associated General Contractors of America to be held at Washington Jan. 29-31. The three major units of the industry, each represented by an autonomous division within the association, the heavy engineering and railroad contractors, the highway contractors and the building contractors, all are to take part in the convention. In anticipation of the early signing of the basic code for the construction industry, plans have been made to complete the organization of the general contractors divisional code authority during the convention and to lay the groundwork for local administration throughout the country. Other subjects for discussion are the increasing tendency to use day labor on highway and heavy engineering projects, the diversion of gasoline taxes from highway work, the securing of dependable building appraisals and the revival of private construction. Special attention is to be paid to the variation in construction wages and labor policies promulgated by various governmental agencies. A. C. Tozzer, president of the association, points out that four or more totally different and unrelated sets of wage rates have been promulgated by various public agencies for identical types of work in identical communities.

Suits Brought Against Cleveland By Activated Sludge, Inc.

Litigation has been begun to halt the construction of the Easterly sewage plant at Cleveland, Ohio, by Activated Sludge, Inc., of Chicago, Ill. The company contends that the plant, which is designed to employ the activated-sludge process, is being built in violation of its patent rights.

Two suits have been brought against the city. One, brought in the common pleas court relates to patents on the activated-sludge process and seeks to enjoin the city from awarding contracts on Jan. 12 for a large amount of equipment. The other suit, in the federal court, asks that the city be enjoined from installing apparatus alleged to be covered by patents owned by the company. It also asked the court to appoint a master to hear the case and determine the amount of damages due Activated Sludge, Inc. Council for the company recently said about $750,000 would be requested from the city for the right to employ the activated-sludge process.

Early last year (ENR Feb. 23, 1933, p. 264) the federal district court at Miwaukee decided that the patent claims of Activated Sludge, Inc., were valid. The case was appealed by the city and arguments were heard by the Circuit Court of Appeals on December 5. A similar suit has been in process of litigation in Chicago for several years. Arguments were scheduled for Nov. 27 but were deferred until Jan. 30. Suits also have been filed against Indianapolis, Ind., Woonsocket, R. I., and Hagerstown, Md.

SOCIETY CALENDAR

ASSOCIATED GENERAL CONTRACTORS, annual convention, Washington, D. C., Jan. 29-31, 1934.

AMERICAN CONCRETE INSTITUTE, Toronto, Ontario, Canada, Feb. 20-22, 1934.

AMERICAN RAILWAY ENGINEERING ASSOCIATION, Chicago, Ill., March 13-14, 1934.

AMERICAN ROAD BUILDERS ASSOCIATION, annual convention, Chicago, Jan. 22-26, 1934.

AMERICAN SOCIETY FOR TESTING MATERIALS, Atlantic City, N. J., June 25-29, 1934.

AMERICAN TOLL BRIDGE ASSOCIATION, annual convention, Cincinnati, Ohio, Jan. 26-27, 1934.

AMERICAN WOOD PRESERVERS ASSOCIATION, Houston, Texas, Jan. 23-25, 1934.

AMERICAN WATER WORKS ASSOCIATION, annual convention, New York, June 4-8, 1934.

CANADIAN CONSTRUCTION ASSOCIATION, Toronto, Ont., Jan. 22-26, 1934.

ENGINEERING INSTITUTE OF CANADA, 48th annual general meeting, Montreal, Que., Feb. 8-9, 1934.

SMOKE PREVENTION ASSOCIATION, annual convention, June 19-22, Buffalo, N. Y.

THE 20TH ANNUAL ROAD SCHOOL, at Purdue University, Lafayette, Ind., is to be held there Jan. 22-26.

NEW YORK STATE COUNTY SUPERINTENDENTS' ASSOCIATION will hold its annual meeting at Albany, N. Y., Jan. 31 and Feb. 1.

ASSOCIATED GENERAL CONTRACTORS OF MISSOURI will hold their annual meeting at the Mayfair Hotel, St. Louis, on Jan. 27.

PORTLAND SECTION, American Society of Civil Engineers, at its annual meeting held early in January, elected Carl F. Thomas, district engineer, S.P.&S. Railway, president; Lyman Griswold and James H. Polhemus vice-presidents, and George H. Canfield, secretary, and Geary Kimbrell, treasurer.

METROPOLITAN SECTION, American Society of Civil Engineers, at its meeting on Jan. 10 was addressed by Charles P. Berkey, professor of geology, Columbia University, and consultant on foundations at a number of the principal dam projects in the country. Dr. Berkey took as his subject the geologic features of Boulder Dam, the Grand Coulee dam, dams of the Los Angeles Flood Control District and of the Tennessee Valley Authority work, also Madden Dam in the Canal Zone.

Collapsed Coal Pocket Designer Granted a New Trial

By a decision on Jan. 9 the Court of Appeals of New York State granted a new trial to Paul Orzel who was held negligently responsible by a Bronx County jury in 1930 for the collapse of a coal pocket, (*ENR*, February 27, 1930, p. 377) the design of which he had worked upon. The court had given Mr. Orzel a suspended sentence and deprived him of the right to practice engineering except under the direction of a licensed engineer. The ruling of the Court of Appeals has the effect of reversing the decision of the lower court.

Board to Approve All Work Proposed for Mississippi Valley

All projects covering flood control, water power development, navigation, irrigation, reforestation, soil erosion or water conservation proposed to the Public Works Administration for financing, are to be passed upon by the Mississippi Valley Committee of the PWA if they fall within the Mississippi River drainage area. Part or all of 32 states are included in the drainage area.

State Highway Officials Urge Granting of More Road Funds

Calling attention to the fact that the peak of construction with the highway funds now available will occur in April or May of this year, the American Association of State Highway Officials urges that Congress make provision for further federal-aid funds for work during the latter half of the year 1934. On Jan. 1, 64 per cent of the $400,000,000 provided for highway work under the National Recovery Act had been put under contract or was advertised for contracts, and it is expected that 90 per cent of the money will be advertised for contract by March 1.

Brief News

CONSTRUCTION OF A VEHICLE TUNNEL under the Delaware River below Philadelphia, authorized by a bill recently passed by the Pennsylvania state legislature, is provided for in a bill now before the state legislature of New Jersey.

BIDS ON THE FIRST WORK to be put under contract for the $7,000,000 bridge across the Mississippi River at Baton Rouge, La., are expected to be awarded in April so that pier work in the river can be begun as soon as the high water subsides.

PURCHASE OF THE WABASH RAILROAD BRIDGE and tunnel at Pittsburgh for highway purposes, proposed in the county program for work to be carried out with PWA funds, has been disapproved by a committee of the city council of Pittsburgh on the grounds that such funds should not be used for the purchase of old structures.

WORK ON A RESERVOIR being built at Stamping Ground, Ky., by the CWA has been stopped by Thornton Wilcox, administrator of relief and civil works in Kentucky. After about $1,500 had been spent, the administrator discovered that the chief beneficiary was to be a private company which, it is reported, had donated the site and the town's share of the construction cost.

A REPORT ON THE MOST DESIRABLE ROUTE and the cost of a ship canal across New Jersey from the Delaware River below Trenton to the Raritan River and New York Bay has been submitted to Congress by Secretary of War Dern. Construction of the canal is estimated to cost $210,000,000. A survey of the canal and an estimate of its cost was authorized by Congress in 1930. The Secretary makes no recommendations as to the advisability of building a canal.

A COMPLETE INVESTIGATION of the cement supply problems of the Metropolitan Water District of Southern California has been ordered by the district board of directors. The district will use about 5,000,000 barrels of cement in the construction of the Colorado River aqueduct. The investigation to be made for the directors will include a report on the construction of a cement plant by the district, to be operated for the production of cement for district use.

CONSTRUCTION HAS BEEN BEGUN on a new demonstration plant for the manufacture of phosphoric acid and phosphatic fertilizers at Muscle Shoals by the Tennessee Valley Authority as an addition to nitrate plant No. 2. Also two of the elec-

tric furnaces in nitrate plant No. 2 are being remodeled for smelting of phosphate rock. Later a blast furnace is to be built. Construction is being carried on by Stone & Webster Engineering Corp. with D. C. Powers as construction superintendent.

Personal

H. G. PHILBRICK, formerly with the Stone & Webster Engineering Corp., Boston, has been named one of the executives for the Civil Works Administration in Massachusetts.

ROSWELL G. HALL has been appointed superintendent of public buildings for the city of Boston, succeeding JOHN P. ENGLERT, who recently resigned this post. Mr. Hall has been active in Boston real estate circles for 26 years, and has been prominent in appraisal work in Massachusetts.

CHESTER K. WENTWORTH, associate professor of geology at Washington University in St. Louis for the past five years, and geologist on various survey and exploration projects with the U. S. Engineer Office at Kansas City, has been appointed geologic engineer for the Honolulu board of water supply. He will make aerial and sub-surface studies in connection with the development of potential water supplies for the city.

JOHN SHISLER has been appointed city engineer of Canton, Ohio, by the new administration. After 18 years of service in the engineering department of the city, Mr. Shisler was removed from office by a previous administration and court action begun following his removal to have him reinstated under the civil service laws of the state is still in the courts.

BYRON BIRD, formerly city engineer, Fort Dodge, Iowa, has been appointed professor of hydraulic engineering at the University of Iowa to fill the vacancy left by the death of Prof. Floyd Nagler. Professor Bird is a native of Fort Dodge and a graduate of Iowa State College and of the University of Wisconsin in the class of 1915. He served as assistant engineer on the Miami Conservancy District work from 1915 to 1917, and in 1919 went to Texas A. & M. College as an instructor in highway engineering, later becoming professor of structural engineering.

Obituary

GEORGE F. SYME, senior highway engineer, State Highway Commission, Raleigh, N. C., was killed accidentally on Nov. 27 while hunting near Pittsboro, N. C. Mr. Syme had been with the North Carolina Highway Commission since 1916. He inaugurated the practice of applying geodetic control to all survey work of the state highway department.

CHARLES A. KOENER, retired general contractor, Louisville, Ky., died there on Jan. 10, age 79 years.

ALEXANDER W. VARS, city engineer, Plainfield, N. J., died there suddenly on Jan. 14, age 60 years. Mr. Vars had been city engineer since 1920. His early engineering experience was gained in the offices of F. A. Dunham and Harry C. VanEmburg, Plainfield, and included highway work in Union County and the sewage disposal system of Westfield, N. J. He became city engineer of Westfield following the completion of the sewer project.

JAMES R. CHAPMAN, former chief engineer of the underground electric railways of London, died at Santa Barbara, Calif., on Jan. 11, age 82 years. Mr. Chapman studied engineering at the University of Vermont and at Massachusetts Institute of Technology, and after graduation went into railway work in the South and East and subsequently in the Southwest. Later he went into street railway work, becoming electrical engineer on the elevated railways of Chicago. In 1901 he went to London and remained there until 1910.

CONSTRUCTION STATISTICS OF THE WEEK

THE decrease in contract awards for this week is in the highway work. The total awards for the week are $23,942,000 compared with $27,412,000 last week and a previous 4-weeks' average of $26,213,000. Highway awards dropped from $15,110,000 to $7,226,000. Federal awards increased to $9,679,000 while state and municipal awards dropped to $11,451,000. The Federal awards for the week are over, and the state and municipal awards are below the December average.

Private awards for the week also are low. Industrial buildings dropped to $748,000 from last week's total of $3,120,000, and commercial buildings awards increased from $1,395,000 last week to $1,464,000 for the current week.

The larger contracts for the week include the Fillmore-Lovejoy drain, Buffalo, N. Y., $964,000, the Montgomery Island Dam on the Ohio River, $2,436,566, two bridges on the Cape Code Canal in Massachusetts $1,444,730, roads in Mississippi $1,104,132 and in Michigan $789,136, levees in Tennessee $1,703,000.

In the week's new financing PWA allotments dropped from $125,985,000 last week to $24,407,000 and municipal bond sales increased from $813,000 to $2,127,000. New capital was further augmented by new capital stock issues totalling $2,905,000 for distillery construction. The cumulative new capital total is $252,572,000, including $44,576,000 in federal allotments.

CONTRACTS
(Thousands of Dollars)

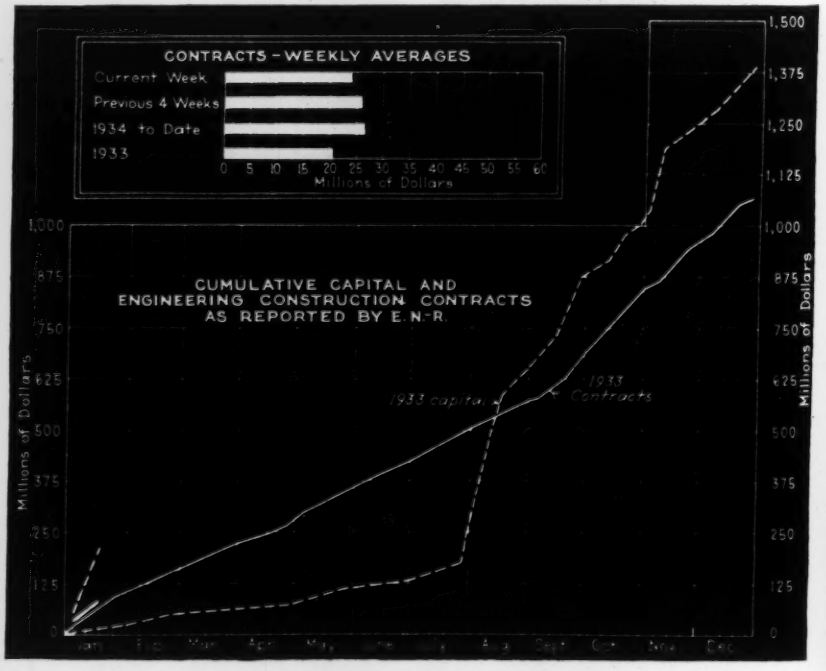
	Weekly Average Jan. 1933	Prev. 4 Weeks	Week Jan. 18, 1934
Federal Government	$3,636	$5,608	$9,679
State and municipal	15,810	14,153	11,451
Total public	$19,446	$19,761	$21,130
Total private	4,402	6,452	2,812
Week's total	$23,848	$26,213	$23,942

Cumulative to date:
1933.....$77,875 1934.....$78,942

NEW PRODUCTIVE CAPITAL
(Thousands of Dollars)

1934	Week Jan. 18	Cumulative
State and municipal	$2,127	$7,892
PWA allotments, S&M	19,659	161,572
Corporate issues	2,905	2,905
PWA allotments, private	4,748	35,627
Total, Non-Federal	$29,439	$207,996
PWA allotments Federal Constr.	710	44,576
Total new capital	$30,149	$252,572

Cumulative total to date:
1933.....$22,900 1934.....$207,995
Rescinded or reduced allotments (from 1933 PWA totals).... $35,908

INDEX NUMBERS

E.N.-R.-Cost		E.N.-R.-Volume	
January, 1934	**191.26**	**December, 1933**	**116**
December, 1933	192.14	November, 1933	133
January, 1932	158.44	December, 1932	113
1933 (Average)	170.28	1933 (Average)	102
1932 (Average)	156.97	1932 (Average)	127
1931 (Average)	181.35	1931 (Average)	220
1913 (Average)	100